Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Empowered Autonomous)

Four Year B.Sc. Degree Program in Computer Science

(Faculty of Science & Technology)

CBCS Syllabus

S.Y.B.Sc.(Computer Science) Semester -IV

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

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.

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

Syllabus

(NEP-2020: 2023 Pattern)

Credit Distribution Structure for F.YB.Sc.(Computer Science) (Pattern 2023)

Level	SEM	Major		Minor	GE/OE	VSC, SEC (VSEC)	AEC, VEC, IKS	OJT, FP, CEP, CC, RP	Cum. Cr./ Sem.	Degree/ Cum. Cr.
		Mandatory	Electives							
4.5	I	**COS-101-MJM:** Basic Programming using C **COS-102-MJM:**DBMS-I **COS-103-MJM:**Computer Science Practical – I **Credits-2+2+2**	--	--	**COS-116-OE**Internet Awareness (TH) **COS-117-OE:**Introduction to MS-Office (PR) Credit- 2+2	**COS-126-SEC(ST):** Introduction to Statistical Software OR (PR) **COS-126-SEC(MT)** Mathematics for Computer Science OR **COS-126-SEC(EL)** Electronics Pract.-I **COS-121-VSC:**(TH) Problem Solving Skills & DBMS Using PostgreSQL Credit- 2+2	**ENG-131-AEC:**Functional English – I **COS-137-IKS:**Evolution of Computer **COS-135-VEC:** Environmental Science Credit- 2+2+2	**CC:** NSS/NCC/Yoga/Cultural Activity/Sports Credit- 2	22	**UG Certificate44**
	II	**COS-151-MJM:**: Advanced Programming Using C **COS-152-MJM:** DBMS-II **COS-153-MJM:** Computer Science Practical – II Credits-2+2+2		**COS-161-MN(ST):**: Exploratory Data Analysis-I OR **COS-161-MN(EL):**: Fundamentals of Electronics OR **COS-161-MN(MT):**Discrete Mathematics Credits-2	**COS-166-OE**Advanced MS-Excel **COS-167-OE** E-Banking Credit- 2+2	**COS-176-SEC:** Basic Graphics Design using C **COS-171-VSC:** Database Applications using PL/pgSQL Credit- 2+2	**ENG-181-AEC:** Functional English – II **COS-185-VEC:** Digital and Technological Solutions Credit- 2+2	**CC:** NSS/NCC/Yoga/Cultural Activity/Sports Credit- 2	22	
	Cum Cr.	**12**	**-**	**2**	**8**	**8**	**10**	**4**	**44**	

Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

*** 1 Credit = 15 hr.**

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**

Sr.No	Sem	Course Type	Title of course	Course Type	Theory / Pract.	No. of Credits
1	S.Y.B.Sc. (CS) Sem - IV NEP-2023	COS-251-MJM	Advanced Data Structure	Major Mandatory	Theory	2
2		COS-252-MJM	Advanced Web Technology	Major Mandatory	Theory	2
3		COS-253-MJM	Java Programming	Major Mandatory	Theory	2
4		COS-254-MJM	Lab Course I – Based on COS-251-MJM, COS-252-MJM	Major Mandatory	Practical	2
5		COS-261MN(A), COS-261-MN(B), COS-261-MN(C)	Statistics, Mathematics, Electronics	Minor (any one)	Theory	2
6		COS-262-MN(A), COS-262-MN(B), COS-262-MN(C)	Statistics, Mathematics, Electronics	Minor (any one)	Practical	2
7		COS-261-MN(D)	JAVA Script & Bootstrap	Minor (For Other)	Theory	2
8		COS-262-MN(D)	Lab Course based on COS-261-MN(D)	Minor (For Other)	Practical	2
9		COS-216-OE	Basic Tools of Digital Marketing	Open Elective (OE)	Practical	2
10		COS-276-SEC	Lab Course on COS-253-MJM	Skill Enhancement Course (VSC)	Practical	2
11		MAR-231- AEC, HIN-231-AEC, SAN-231-AEC	Marathi, Hindi, Sanskrit	Ability Enhancement Course (AEC)	Theory	2
12		YOG/PES/CUL/ NSS/ NCC-239-CC	To be selected form the basket	Co-curricular Course (CC)	Theory	2
13		COS-285-CEP	Community Engagement Project	Community Engagement Project	Practical	2
TOTAL Credits of SEM -IV =						**22**

SYLLABUS (CBCS as per NEP 2020) FOR S. Y. B. Sc. (Computer Science) Sem-IV
(w. e. from A.Y. 2024-25)

Name of the Programme	**:** B.Sc. Computer Science
Program Code	: USCOS
Class	**:** S.Y.B.Sc. (Computer Science)
Semester	IV
Course Type	**:** Major
Course Name	**:** Advance Data Structures (TH)
Course Code	**:** COS-251-MJM
No. of Lectures	30
No. of Credits	02

Prerequisites:

- Basic knowledge of algorithms and problem solving.
- Knowledge of basic Data Structures.
- Knowledge of CPP 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 using recursion.

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

CO3. Understand different structures such as queue, trees, and graph.

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	**Recursion** 1.1 Simulating recursion using stack 1.2 Recursion Algorithms 1.2.1 Fibonacci Series 1.2.2 Tower of Hanoi	**4**
Unit 2	**Queues** 2.1 Introduction 2.2 Representation - Static & Dynamic 2.3 Operations – Create , Init , Insert , Remove & Display 2.4 Circular queue, priority queue (with implementation) 2.5 Concept of doubly ended queue (Dequeue)	**6**
Unit 3	**Trees** 3.1 Concept & Terminologies 3.2 Binary tree, binary search tree 3.3 Representation – Static and Dynamic 3.4 Operations on BST & Heap Tree – create, Insert, delete, traversals (preorder, inorder, postorder), counting leaf, non-leaf & total nodes , non recursive inorder traversal 3.5 Application - Heap sort 3.6 Height balanced tree- AVL trees- Rotations, AVL tree examples.	**10**
Unit 4	**Graph** 4.1 Concept & terminologies 4.2 Graph Representation – Adjacency matrix, adjacency list, inverse Adjacency list, adjacency multi list, orthogonal list 4.3 Traversals – BFS and DFS 4.4 Spanning Tree 4.5 Applications – AOV network – topological sort, AOE network – critical path	**10**

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

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

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.

SYLLABUS (CBCS as per NEP 2020) FOR S. Y. B. Sc. (Computer Science) Sem-IV
(w. e. from A.Y. 2024-25)

Name of the Programme	**:** B.Sc. Computer Science
Program Code	: USCOS
Class	**:** S.Y.B.Sc. (Computer Science)
Semester	IV
Course Type	**:** Major
Course Name	**:** Advanced Web Technology (TH)
Course Code	**:** COS-252-MJM
No. of Lectures	**30**
No. of Credits	**02**

Prerequisites:

- Basic knowledge of Computers and its concepts.

Course Objectives:

1: To design web pages using HTML5, CSS, JavaScript and Bootstrap.
2: To design dynamic, interactive and elegant Web sites.
4: To analyze a web page and identify its elements and attributes.
5: To create web pages using Cascading Style Sheets. Build dynamic web pages using JavaScript (Client-side programming).
6: To Build dynamic web pages using JavaScript (Client-side programming).
7: To Acquire the basic concepts of the Web with reference to its architecture.

Course Outcomes:

CO1: Students will be able to Design web pages using HTML5, CSS, JavaScript and Bootstrap.
CO2: Students will be able to Design dynamic, interactive and elegant Web sites.
CO3: Students will be able to Analyze a web page and identify its elements and attributes.
CO4: Students will be able to Create web pages using Cascading Style Sheets. Build dynamic web pages using JavaScript (Client-side programming).
CO5: Students will be able to Build dynamic web pages using JavaScript (Client side programming).
CO6: Students will be able to Build dynamic web pages using JavaScript (Client side programming).
CO7: Students will be able to Acquiring the basic concepts of the Web with reference to its architecture.

Unit	Title and Contents	No. of Lectures
Unit 1	**Advanced HTML5** **1.1** The Meter Element **1.2** Working with Multimedia **1.3** Image Mapping **1.4** HTML Canvas **1.5** HTML SVG **1.6** Web Storage: Local storage and session storage	07
Unit 2	**Advanced CSS** **2.1** CSS Box Model **2.2** CSS Fonts **2.3** CSS Text **2.4** CSS Forms **2.5** CSS Transitions **2.6** CSS Animations	07
Unit 3	**Basics of JavaScript** **3.1** Introduction to JavaScript **3.2** JavaScript Basics – Data Types, Control Structure **3.3** JavaScript Functions **3.4** Working with events **3.5** JS Popup boxes	10
Unit 4	**Basics of Bootstrap** **4.1** Introduction to Bootstrap **4.2** Use and Advantages of Bootstrap **4.3** How to get Bootstrap **4.4** Bootstrap Containers, Grids, Carousel, Navbar **4.5** Bootstrap Forms, Radio Button, Checkbox, Dropdowns	06

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. Head First 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.
5. JavaScript: The Definitive Guide, Publisher – O'Reilly
6. JavaScript & JQuery: Interactive Front-End Web Development, Publisher – Wiley
7. Bootstrap 5 Foundations, by Daniel Foreman
8. Bootstrap, by Jake Spurlock, Publisher(s): O'Reilly Media, Inc.

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

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

Justification of Mapping of PO1 with All CO'S

CO1: PO1: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap demonstrates a comprehensive understanding of foundational web development principles, aligning strongly with PO1's focus on fundamental theories and methodologies.
CO2: PO1: Creating dynamic, interactive, and elegant websites requires a profound understanding of advanced web development concepts, which is highly relevant to PO1.
CO3: PO1: Analyzing web pages and identifying their elements and attributes involves applying foundational knowledge, which moderately contributes to a comprehensive understanding of web concepts as outlined in PO1.
CO4: PO1: Creating web pages using Cascading Style Sheets and building dynamic web pages using JavaScript indicates a strong grasp of essential web development techniques, strongly mapping to PO1.
CO5: PO1: Building dynamic web pages using JavaScript showcases the application of client-side programming, demonstrating a solid understanding of programming methodologies, aligning strongly with PO1.
CO6: PO1: Reiterating the building of dynamic web pages using JavaScript emphasizes repeated practice and a strong understanding of client-side programming, making it strongly related to PO1.
CO7: PO1: Acquiring basic web concepts and understanding web architecture provides foundational knowledge, which is moderately related to the comprehensive understanding required in PO1.

Mapping of PO2 with All CO'S

CO1: PO2: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves practical skills and knowledge of industry standards, which are essential for professional tasks, aligning strongly with PO2.
CO2: PO2: Designing dynamic, interactive, and elegant websites requires applying best practices and industry standards, making it highly relevant to PO2.
CO3: PO2: Analyzing a web page and identifying its elements and attributes helps develop procedural knowledge, which is moderately related to acquiring practical and professional skills as described in PO2.

CO4: PO2: Creating web pages using CSS and building dynamic web pages using JavaScript involves hands-on skills and understanding of procedural knowledge and best practices, making it strongly related to PO2.
CO5: PO2: Building dynamic web pages using JavaScript requires practical application of client-side programming skills, aligning strongly with the practical and professional aspects of PO2.
CO6: PO2: Emphasizing repeated practice in building dynamic web pages using JavaScript further demonstrates strong practical expertise, making it highly related to PO2.
CO7: PO2: Acquiring basic concepts of the web and understanding its architecture provides foundational knowledge but only partially contributes to the practical and professional skills focus of PO2.

Mapping of PO3 with All CO'S

CO1: PO3: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap provides technical skills that can help identify business opportunities in web development, moderately contributing to an entrepreneurial mindset.
CO2: PO3: Designing dynamic, interactive, and elegant websites can drive innovation in web solutions and attract business opportunities, making it strongly related to fostering an entrepreneurial mindset.
CO3: PO3: Analyzing web pages and identifying elements and attributes can aid in understanding market dynamics and customer preferences, which moderately supports an entrepreneurial perspective.
CO4: PO3: Creating web pages using CSS and building dynamic web pages using JavaScript encourages innovation in web design, contributing moderately to the entrepreneurial mindset.
CO5: PO3: Building dynamic web pages using JavaScript involves creating interactive features, which can foster innovative thinking and moderate entrepreneurial opportunities.
CO6: PO3: Repeated practice in building dynamic web pages using JavaScript also encourages innovative web solutions, moderately contributing to entrepreneurial knowledge.
CO7: PO3: Acquiring basic concepts of the web and its architecture provides foundational knowledge but only partially supports the development of an entrepreneurial mindset.

Mapping of PO4 with All CO'S

CO1: PO4: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves technical proficiency and problem-solving skills, which are essential specialized competencies relevant to PO4.
CO2: PO4: Designing dynamic, interactive, and elegant websites requires advanced technical skills, creativity, and problem-solving abilities, making it strongly related to the development of specialized skills and competencies.
CO3: PO4: Analyzing web pages to identify elements and attributes develops analytical skills and supports effective communication about web structure, which moderately aligns with PO4.
CO4: PO4: Creating web pages using CSS and building dynamic web pages using JavaScript fosters proficiency in technical skills and the ability to adapt and innovate in web design, making it strongly related to PO4.
CO5: PO4: Building dynamic web pages using JavaScript enhances problem-solving and technical skills, demonstrating strong alignment with the specialized competencies in PO4.
CO6: PO4: Repeated practice in building dynamic web pages using JavaScript further solidifies technical skills and adaptability, strongly contributing to PO4.
CO7: PO4: Acquiring basic concepts of the web and its architecture provides foundational knowledge that supports analytical abilities and technical communication, moderately related to PO4.

Mapping of PO5 with All CO'S

CO1: PO5: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves applying learned concepts and solving practical problems in web development, demonstrating strong analytical reasoning and creativity, which aligns strongly with PO5.

CO2: PO5: Designing dynamic, interactive, and elegant websites requires applying critical thinking and creativity to solve complex design and user experience challenges, making it strongly related to PO5.

CO3: PO5: Analyzing web pages to identify elements and attributes requires critical thinking and analytical reasoning, which moderately supports the capacity for problem-solving as outlined in PO5.

CO4: PO5: Creating web pages using CSS and building dynamic web pages using JavaScript involves solving technical problems and applying web development concepts in practical scenarios, strongly aligned with PO5.

CO5: PO5: Building dynamic web pages using JavaScript showcases the ability to solve client-side programming challenges, demonstrating strong application and problem-solving skills, which are core to PO5.

CO6: PO5: Repeated practice in building dynamic web pages using JavaScript further enhances problem-solving, adaptability, and readiness to tackle complex programming challenges, making it strongly related to PO5.

CO7: PO5: Acquiring basic concepts of the web and its architecture provides foundational knowledge that supports problem-solving and analytical reasoning, making it moderately related to PO5.

Mapping of PO6 with All CO'S

CO1: PO6: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap requires the ability to communicate technical concepts clearly and effectively, both orally and in writing, but collaboration is not a primary focus, making it moderately related to PO6.

CO2: PO6: Designing dynamic, interactive, and elegant websites often involves teamwork and collaboration, and it requires clear communication of design ideas and technical specifications, making it moderately related to PO6.

CO3: PO6: Analyzing a web page and identifying its elements and attributes involves explaining technical details and findings, which requires communication skills. This outcome moderately supports PO6.

CO4: PO6: Creating web pages using CSS and building dynamic web pages with JavaScript involves explaining the development process, which requires good communication skills. However, it only moderately relates to collaboration aspects of PO6.

CO5: PO6: Building dynamic web pages using JavaScript may require collaborating with peers or team members, and effectively communicating the web functionalities, making it moderately related to PO6.

CO6: PO6: Repeated practice in building dynamic web pages involves communication of progress and collaborative problem-solving, but the primary focus is still technical skills rather than communication, making it moderately related to PO6.

CO7: PO6: Acquiring basic concepts of the web and its architecture involves foundational knowledge. While some communication is needed to convey these concepts, it is only partially related to developing strong communication skills or collaborative efforts.

Mapping of PO7 with All CO'S

CO1: PO7: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves applying technical skills rather than focusing on research-related skills such as inquiry, data collection, and analysis, making it only partially related to PO7.

CO2: PO7: Designing dynamic, interactive, and elegant websites requires some level of observation and creativity but does not directly focus on research methodologies or formulating research questions, making it partially related to PO7.

CO3: PO7: Analyzing a web page and identifying its elements and attributes involves observational skills and some analytical reasoning, which moderately supports research-related skills, especially in formulating analysis-based questions.

CO4: PO7: Creating web pages using CSS and building dynamic web pages using JavaScript involves some level of inquiry, observation, and analysis during development, moderately contributing to research-related skills.

CO5: PO7: Building dynamic web pages using JavaScript focuses more on applying technical skills than on developing research-based inquiry and analytical methods, making it only partially related to PO7.

CO6: PO7: Repeated practice in building dynamic web pages using JavaScript enhances technical proficiency rather than directly supporting research-related skills, making it partially related to PO7.

CO7: PO7: Acquiring basic concepts of the web and its architecture can involve observational skills and foundational inquiry, which are moderately related to the development of research-related skills as outlined in PO7.

Mapping of PO8 with All CO'S

CO1: PO8: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap requires continuous self-directed learning and adapting to new tools, frameworks, and standards, which aligns strongly with "Learning How to Learn" skills in PO8.

CO2: PO8: Designing dynamic, interactive, and elegant websites involves self-learning of advanced web design techniques and practices, requiring students to independently learn and adapt to evolving web development trends, strongly supporting PO8.

CO3: PO8: Analyzing a web page and identifying its elements and attributes requires some level of independent learning to understand and interpret web development concepts, making it moderately related to PO8.

CO4: PO8: Creating web pages using CSS and building dynamic web pages with JavaScript requires learning various styling and scripting techniques independently, strongly supporting the skills outlined in PO8.

CO5: PO8: Building dynamic web pages using JavaScript involves continual self-learning and adapting to changes in client-side programming practices and libraries, making it strongly related to PO8.

CO6: PO8: Repeated practice in building dynamic web pages using JavaScript requires adapting and learning new features, libraries, or methods, reinforcing independent learning skills, making it strongly related to PO8.

CO7: PO8: Acquiring basic concepts of the web and its architecture involves some self-learning and adapting to new foundational concepts, which moderately supports the skills required in PO8.

Mapping of PO9 with All CO'S

CO1: PO9: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap requires proficiency in digital and technological skills, including the use of various ICT tools and software, making it strongly related to PO9.

CO2: PO9: Designing dynamic, interactive, and elegant websites involves using advanced web development tools and software, demonstrating a high level of digital and technological proficiency, which aligns strongly with PO9.

CO3: PO9: Analyzing a web page and identifying its elements and attributes involves using digital tools to inspect and understand web components, which requires moderate digital and technological skills, making it moderately related to PO9.

CO4: PO9: Creating web pages using CSS and building dynamic web pages with JavaScript involves using various coding tools and environments, demonstrating strong proficiency in digital and technological skills, which strongly aligns with PO9.

CO5: PO9: Building dynamic web pages using JavaScript requires extensive use of ICT tools, debugging software, and other technologies, demonstrating strong digital skills and proficiency, making it strongly related to PO9.

CO6: PO9: Repeated practice in building dynamic web pages using JavaScript further enhances digital skills and the use of various development tools, which strongly supports the requirements of PO9.

CO7: PO9: Acquiring the basic concepts of the web and its architecture involves foundational digital skills and understanding of technological platforms, which moderately relates to the development of digital and technological skills in PO9.

Mapping of PO10 with All CO'S

CO1: PO10: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap focuses on technical skills and does not directly involve multicultural competence or empathy, making it only partially related to PO10.

CO2: PO10: Designing dynamic, interactive, and elegant websites may require considering diverse user experiences and accessibility, but it does not primarily focus on multicultural competence or inclusive spirit, making it partially related to PO10.

CO3: PO10: Analyzing a web page and identifying its elements and attributes involves technical understanding rather than engagement in multicultural settings or demonstrating empathy, making it partially related to PO10.

CO4: PO10: Creating web pages using CSS and building dynamic web pages using JavaScript focuses on technical competencies and does not directly involve leading diverse teams or showing empathy, making it partially related to PO10.

CO5: PO10: Building dynamic web pages using JavaScript is more about technical skills and does not directly connect with multicultural competence, inclusive spirit, or empathy, making it partially related to PO10.

CO6: PO10: Repeated practice in building dynamic web pages using JavaScript focuses on enhancing technical skills rather than multicultural competence or empathy, making it partially related to PO10.

CO7: PO10: Acquiring the basic concepts of the web and its architecture may involve understanding global and diverse perspectives in web accessibility and design, which can moderately contribute to multicultural competence and inclusivity as outlined in PO10.

Mapping of PO11 with All CO'S

CO1: PO11: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves technical skills without a direct focus on ethical values, sustainability, or environmental awareness, making it partially related to PO11.

CO2: PO11: Designing dynamic, interactive, and elegant websites is primarily a technical task and does not directly address value inculcation or environmental awareness, making it partially related to PO11.

CO3: PO11: Analyzing a web page and identifying its elements and attributes focuses on technical analysis rather than on ethical or environmental considerations, making it partially related to PO11.

CO4: PO11: Creating web pages using CSS and building dynamic web pages with JavaScript emphasizes technical development and does not directly relate to ethical values or environmental awareness, making it partially related to PO11.

CO5: PO11: Building dynamic web pages using JavaScript focuses on technical skills rather than addressing ethical issues or promoting environmental conservation, making it partially related to PO11.

CO6: PO11: Repeated practice in building dynamic web pages using JavaScript is centered on technical expertise and does not directly involve value inculcation or environmental concerns, making it partially related to PO11.

CO7: PO11: Acquiring basic concepts of the web and its architecture is foundational and does not directly address ethical values or environmental awareness, making it partially related to PO11.

Mapping of PO12 with All CO'S

CO1: PO12: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves applying knowledge independently and managing web design tasks, demonstrating moderate responsibility and accountability.

CO2: PO12: Designing dynamic, interactive, and elegant websites requires managing various aspects of web development projects independently, which moderately relates to autonomy and accountability in project management.

CO3: PO12: Analyzing a web page and identifying its elements and attributes involves applying analytical skills independently, which moderately supports the demonstration of responsibility and accountability in work contexts.

CO4: PO12: Creating web pages using CSS and building dynamic web pages with JavaScript involves significant project management, independent problem-solving, and accountability for the development process, strongly aligning with PO12.

CO5: PO12: Building dynamic web pages using JavaScript involves managing programming tasks independently and demonstrating responsibility in the development and implementation of features, strongly supporting PO12.

CO6: PO12:Repeated practice in building dynamic web pages using JavaScript requires effective project management, independent work, and accountability, demonstrating strong alignment with PO12.

CO7: PO12: Acquiring basic concepts of the web and its architecture involves self-directed learning and understanding fundamental principles, which moderately relates to autonomy and responsibility in learning contexts.

Mapping of PO13 with All CO'S

CO1: PO13: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap is primarily a technical skill and does not directly involve community engagement or promoting societal well-being, making it partially related to PO13.

CO2: PO13: Designing dynamic, interactive, and elegant websites focuses on technical skills and does not inherently involve community service or engagement, making it partially related to PO13.

CO3: PO13: Analyzing a web page and identifying its elements and attributes is a technical activity with limited direct connection to community engagement or societal impact, making it partially related to PO13.

CO4: PO13: Creating web pages using CSS and building dynamic web pages using JavaScript involves technical work rather than community service or societal well-being, making it partially related to PO13.

CO5: PO13: Building dynamic web pages using JavaScript is focused on technical skills and does not directly contribute to community engagement or societal well-being, making it partially related to PO13.

CO6: PO13: Repeated practice in building dynamic web pages using JavaScript is centered on technical proficiency rather than on community involvement or service, making it partially related to PO13.

CO7: PO13: Acquiring basic concepts of the web and its architecture is foundational knowledge and does not directly involve community service or engagement, making it partially related to PO13.

SYLLABUS (CBCS as per NEP 2020) FOR S. Y. B. Sc. (Computer Science) Sem-IV
(w. e. from A.Y. 2024-25)

Name of the Programme	**:** B.Sc. Computer Science
Program Code	: USCOS
Class	**:** S.Y.B.Sc. (Computer Science)
Semester	IV
Course Type	**:** Major
Course Name	**:** Core Java Programming (TH)
Course Code	**:** COS-253-MJM
No. of Lectures	**30**
No. of Credits	**02**

Prerequisites:

- Basic knowledge of programming languages like C, CPP.
- Knowledge of Object Oriented Concepts.

Objective:

1. To learn Object Oriented Programming language
2. To Read Input from users by different ways
3. To Define classes with different access modifiers
4. To handle complex problems using object oriented concepts
5. To handle abnormal termination of a program using exception handling
6. To handle string using String & String Buffer Class
7. To understand file handling using java

Course Outcome :

CO1. Understand Object Oriented Concepts

CO2. Read input from different ways.

CO3. Define class with different access modifiers and create object.

CO4. Write implement real world problems using Java

CO5. Handle exceptions during programs

CO6. Handle String efficiently

CO7. Handle file with different modes and formats

Unit	Title and Contents	No. of Lectures
Unit 1	**An Introduction & Overview to Java** 1.1 A Short History of Java 1.2 Features or buzzwords of Java 1.3 Comparison of Java and C++ 1.4 Java Environment 1.5 Simple java program 1.6 Java Tools – jdb, javap, javadoc 1.7 Java IDE – Eclipse/NetBeans (Note: Only for Lab Demonstration) 1.8 Types of Comments 1.9 Data Types 1.10 Final Variable 1.11 Declaring 1D, 2D array 1.12 Input Accepting Method (Command line argument , console using BufferedReader class, Scanner class)	**8**
Unit 2	**Objects and Classes** 3.1 Defining Your Own Classes 3.2 Access Specifiers (public, protected, private, default) 3.3 Array of Objects 3.4 Constructor, Overloading Constructors and use of 'this' Keyword 3.5 static block, static Fields and methods 3.6 Predefined class – Object class methods (equals(), toString(), hashcode(), getClass()) 3.7 Creating, Accessing and using Packages 3.8 Wrapper Classes 3.10 Garbage Collection (finalize() Method)	**10**
Unit 3	**Inheritance and Interface** 4.1 Inheritance Basics (extends Keyword) and Types of Inheritance 4.2 Superclass, Subclass and use of Super Keyword 4.3 Method Overriding and runtime polymorphism 4.4 Use of final keyword related to method and class 4.5 Use of abstract class and abstract methods 4.6 Defining and Implementing Interfaces 4.7 Runtime polymorphism using interface 4.7 Object Cloning	**8**
Unit 4	**Exception Handling** 5.1 Dealing Errors 5.2 Exception class, Checked and Unchecked exception 5.3 Catching exception and exception handling 5.4 Creating user defined exception 5.5 Assertions	**4**
Unit 5	**Strings, Streams and Files** 6.1 String class and StringBuffer Class 6.2 Formatting string data using format() method 6.2 Using the File class 6.3 Stream classes Byte Stream classes Character Stream Classes	

	6.4 Creation of files 6.5 Reading/Writing characters and bytes 6.6 Handling primitive data types 6.7 Random Access files	

References :

1) Complete reference Java by Herbert Schildt (5th edition)
2) Java 2 programming black books, Steven Horlzner
3) Programming with Java , A primer ,Forth edition , By E. Balagurusamy
4) Core Java Volume-I-Fundamentals, Eighth Edition, Cay S. Horstmann, Gary Cornell, Prentice Hall, Sun Microsystems Press

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

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

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 analyse 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 mind-set 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 mind-set 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.

SYLLABUS (CBCS as per NEP 2020) FOR S. Y. B. Sc. (Computer Science) Sem-I
(w. e. from A.Y. 2024-25)

Name of the Programme **:** B.Sc. Computer Science
Program Code : USCOS
Class **:** S.Y.B.Sc. (Computer Science)
Semester IV
Course Type **:** Major
Course Name **:** Lab Course I – Based on COS-251-MJM, COS-252-MJM
Course Code **:** COS-254-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** : Recursion **SET B**: Be acquainted with audio and video tags
Assignment 2	**SET A** : Recursion **SET B**: Practical Implementation of Image Mapping
Assignment 3	**SET A** : Queue **SET B**: Practical implementation of Canvas

Assignment 4	**SET A** : Queue **SET B**: Practical implementation of SVG
Assignment 5	**SET A** : Queue **SET B** : Practical implementation of all kinds of CSS Fonts and Texts
Assignment 6	**SET A** : Tree **SET B** : Designing of Forms with the help of CSS
Assignment 7	**SET A** : Tree **SET B** : Designing of webpage with the help of CSS Transitions.
Assignment 8	**SET A** : Tree **SET B** : Designing of webpage with the help of CSS Animations.
Assignment 9	**SET A** : Tree **SET B** : Practical implementation of control structures in JavaScript
Assignment 10	**SET A** : Tree **SET B** : Practical implementation of control structures in JavaScript
Assignment 11	**SET A** : Graph **SET B** : Practical implementation of Functions in JavaScript
Assignment 12	**SET A** : Graph **SET B** : Practical implementation of Events in JavaScript
Assignment 13	**SET A** : Graph **SET B** : Practical implementation of JS Pop-up boxes in JavaScript
Assignment 14	**SET A** : Graph **SET B** : Designing and Implementation of Navbars, Carousel in Bootstrap
Assignment 15	**SET A** : Graph **SET B** : Designing and Implementation of Forms, Radio Buttons, Checkbox in Bootstrap

References:

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

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-IV
(w. e. from A.Y. 2024-25)

Name of the Programme	**:** B.Sc.(Comp Sci)
Program Code	**:** USCOS
Class	**:** S.Y.B.Sc. (Comp Sci.)
Semester	IV
Course Type	**:** Minor (TH)
Course Name	**:** JavaScript & Bootstrap (TH)
Course Code	**:** COS-261-MN (D)
No. of Lectures	**30**
No. of Credits	**02**

Prerequisites:

- Basic knowledge of Computers and its concepts.

Course Objectives:

1: To design web pages using HTML5, CSS, JavaScript and Bootstrap.

2: To design dynamic, interactive and elegant Web sites.

4: To analyse a web page and identify its elements and attributes.

5: To create web pages using Cascading Style Sheets. Build dynamic web pages using Java Script (Client-side programming).

6: To build dynamic web pages using JavaScript (Client-side programming).

7: To acquire the basic concepts of the Web with reference to its architecture.

Course Outcomes:

CO1: Students will be able to Design web pages using HTML5, CSS, JavaScript and Bootstrap.

CO2: Students will be able to Design dynamic, interactive and elegant Web sites.

CO3: Students will be able to Analyse a web page and identify its elements and attributes.

CO4: Students will be able to create web pages using Cascading Style Sheets. Build dynamic web pages using JavaScript (Client-side programming).

CO5: Students will be able to build dynamic web pages using JavaScript (Client side programming).

CO6: Students will be able to build dynamic web pages using JavaScript (Client side programming).

CO7: Students will be able to Acquiring the basic concepts of the Web with reference to its architecture.

Unit	Title and Contents	No. of Lectures
Unit 1	**Advanced HTML5 & CSS** **1.1** The Meter Element **1.2** Working with Multimedia **1.3** HTML Canvas **1.4** CSS BOX Model **1.5** CSS Text, CSS Animation **1.6** CSS Forms	07
Unit 2	**Introduction to JavaScript** **2.1** What is JavaScript? **2.2** How JavaScript Works: Client-side vs Server-side **2.3** Implementation JavaScript in HTML Script tags, External Js **2.4** JavaScript Syntax and Structure **2.5** JavaScript Variables : var, let, const **2.6** JavaScript Data Types **2.7** JavaScript Operators	07
Unit 3	**JavaScript Control Flow, Function ,Object, Events** **3.1** Conditional Statements (if, else, else if, switch) **3.2** Loops (for, while, do-while) **3.3** JavaScript Function **3.4** Function Parameters and Arguments, Arrow function **3.5** Working with events **3.6** JS Popup boxes	10
Unit 4	**Basics of Bootstrap** **4.1** Introduction to Bootstrap **4.2** Use and Advantages of Bootstrap **4.3** How to get Bootstrap **4.4** Bootstrap Containers, Grids, Carousel, Navbar **4.5** Bootstrap Forms, Radio Button, Checkbox, Dropdowns	06

References:

- Html & CSS: The Complete Reference, Fifth Edition by Thomas A. Powell and published by McGraw Hill.
- The Essential Guide to CSS and HTML Web Design Book by Craig Grannell.
- JavaScript: The Definitive Guide, Publisher – O'Reilly
- JavaScript & JQuery: Interactive Front-End Web Development, Publisher – Wiley
- Bootstrap 5 Foundations, by Daniel Foreman
- Bootstrap, by Jake Spurlock, Publisher(s): O'Reilly Media, Inc.

Course Outcomes	Programme Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13
CO1	3	3	2	3	3	2	1	3	3	1	1	2	1
CO2	3	3	3	3	3	2	1	3	3	1	1	2	1
CO3	2	2	2	2	2	2	2	2	2	1	1	2	1
CO4	3	3	2	3	3	2	2	3	3	1	1	3	1
CO5	3	3	2	3	3	2	1	3	3	1	1	3	1
CO6	3	3	2	3	3	2	1	3	3	1	1	3	1
CO7	2	1	1	2	2	1	2	2	2	2	1	2	1

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

Justification of Mapping of PO1 with All CO'S

CO1: PO1: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap demonstrates a comprehensive understanding of foundational web development principles, aligning strongly with PO1's focus on fundamental theories and methodologies.
CO2: PO1: Creating dynamic, interactive, and elegant websites requires a profound understanding of advanced web development concepts, which is highly relevant to PO1.
CO3: PO1: Analyzing web pages and identifying their elements and attributes involves applying foundational knowledge, which moderately contributes to a comprehensive understanding of web concepts as outlined in PO1.
CO4: PO1: Creating web pages using Cascading Style Sheets and building dynamic web pages using JavaScript indicates a strong grasp of essential web development techniques, strongly mapping to PO1.
CO5: PO1: Building dynamic web pages using JavaScript showcases the application of client-side programming, demonstrating a solid understanding of programming methodologies, aligning strongly with PO1.
CO6: PO1: Reiterating the building of dynamic web pages using JavaScript emphasizes repeated practice and a strong understanding of client-side programming, making it strongly related to PO1.
CO7: PO1: Acquiring basic web concepts and understanding web architecture provides foundational knowledge, which is moderately related to the comprehensive understanding required in PO1.

Mapping of PO2 with All CO'S

CO1: PO2: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves practical skills and knowledge of industry standards, which are essential for professional tasks, aligning strongly with PO2.
CO2: PO2: Designing dynamic, interactive, and elegant websites requires applying best practices and industry standards, making it highly relevant to PO2.
CO3: PO2: Analyzing a web page and identifying its elements and attributes helps develop procedural knowledge, which is moderately related to acquiring practical and professional skills as described in PO2.
CO4: PO2: Creating web pages using CSS and building dynamic web pages using JavaScript involves hands-on skills and understanding of procedural knowledge and best practices, making it strongly related to PO2.

CO5: PO2: Building dynamic web pages using JavaScript requires practical application of client-side programming skills, aligning strongly with the practical and professional aspects of PO2.
CO6: PO2: Emphasizing repeated practice in building dynamic web pages using JavaScript further demonstrates strong practical expertise, making it highly related to PO2.
CO7: PO2: Acquiring basic concepts of the web and understanding its architecture provides foundational knowledge but only partially contributes to the practical and professional skills focus of PO2.

Mapping of PO3 with All CO'S

CO1: PO3: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap provides technical skills that can help identify business opportunities in web development, moderately contributing to an entrepreneurial mindset.
CO2: PO3: Designing dynamic, interactive, and elegant websites can drive innovation in web solutions and attract business opportunities, making it strongly related to fostering an entrepreneurial mindset.
CO3: PO3: Analyzing web pages and identifying elements and attributes can aid in understanding market dynamics and customer preferences, which moderately supports an entrepreneurial perspective.
CO4: PO3: Creating web pages using CSS and building dynamic web pages using JavaScript encourages innovation in web design, contributing moderately to the entrepreneurial mindset.
CO5: PO3: Building dynamic web pages using JavaScript involves creating interactive features, which can foster innovative thinking and moderate entrepreneurial opportunities.
CO6: PO3: Repeated practice in building dynamic web pages using JavaScript also encourages innovative web solutions, moderately contributing to entrepreneurial knowledge.
CO7: PO3: Acquiring basic concepts of the web and its architecture provides foundational knowledge but only partially supports the development of an entrepreneurial mindset.

Mapping of PO4 with All CO'S

CO1: PO4: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves technical proficiency and problem-solving skills, which are essential specialized competencies relevant to PO4.
CO2: PO4: Designing dynamic, interactive, and elegant websites requires advanced technical skills, creativity, and problem-solving abilities, making it strongly related to the development of specialized skills and competencies.
CO3: PO4: Analyzing web pages to identify elements and attributes develops analytical skills and supports effective communication about web structure, which moderately aligns with PO4.
CO4: PO4: Creating web pages using CSS and building dynamic web pages using JavaScript fosters proficiency in technical skills and the ability to adapt and innovate in web design, making it strongly related to PO4.
CO5: PO4: Building dynamic web pages using JavaScript enhances problem-solving and technical skills, demonstrating strong alignment with the specialized competencies in PO4.
CO6: PO4: Repeated practice in building dynamic web pages using JavaScript further solidifies technical skills and adaptability, strongly contributing to PO4.
CO7: PO4: Acquiring basic concepts of the web and its architecture provides foundational knowledge that supports analytical abilities and technical communication, moderately related to PO4.

Mapping of PO5 with All CO'S

CO1: PO5: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves applying learned concepts and solving practical problems in web development, demonstrating strong analytical reasoning and creativity, which aligns strongly with PO5.

CO2: PO5: Designing dynamic, interactive, and elegant websites requires applying critical thinking and creativity to solve complex design and user experience challenges, making it strongly related to PO5.

CO3: PO5: Analyzing web pages to identify elements and attributes requires critical thinking and analytical reasoning, which moderately supports the capacity for problem-solving as outlined in PO5.

CO4: PO5: Creating web pages using CSS and building dynamic web pages using JavaScript involves solving technical problems and applying web development concepts in practical scenarios, strongly aligned with PO5.

CO5: PO5: Building dynamic web pages using JavaScript showcases the ability to solve client-side programming challenges, demonstrating strong application and problem-solving skills, which are core to PO5.

CO6: PO5: Repeated practice in building dynamic web pages using JavaScript further enhances problem-solving, adaptability, and readiness to tackle complex programming challenges, making it strongly related to PO5.

CO7: PO5: Acquiring basic concepts of the web and its architecture provides foundational knowledge that supports problem-solving and analytical reasoning, making it moderately related to PO5.

Mapping of PO6 with All CO'S

CO1: PO6: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap requires the ability to communicate technical concepts clearly and effectively, both orally and in writing, but collaboration is not a primary focus, making it moderately related to PO6.

CO2: PO6: Designing dynamic, interactive, and elegant websites often involves teamwork and collaboration, and it requires clear communication of design ideas and technical specifications, making it moderately related to PO6.

CO3: PO6: Analyzing a web page and identifying its elements and attributes involves explaining technical details and findings, which requires communication skills. This outcome moderately supports PO6.

CO4: PO6: Creating web pages using CSS and building dynamic web pages with JavaScript involves explaining the development process, which requires good communication skills. However, it only moderately relates to collaboration aspects of PO6.

CO5: PO6: Building dynamic web pages using JavaScript may require collaborating with peers or team members, and effectively communicating the web functionalities, making it moderately related to PO6.

CO6: PO6: Repeated practice in building dynamic web pages involves communication of progress and collaborative problem-solving, but the primary focus is still technical skills rather than communication, making it moderately related to PO6.

CO7: PO6: Acquiring basic concepts of the web and its architecture involves foundational knowledge. While some communication is needed to convey these concepts, it is only partially related to developing strong communication skills or collaborative efforts.

Mapping of PO7 with All CO'S

CO1: PO7: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves applying technical skills rather than focusing on research-related skills such as inquiry, data collection, and analysis, making it only partially related to PO7.

CO2: PO7: Designing dynamic, interactive, and elegant websites requires some level of observation and creativity but does not directly focus on research methodologies or formulating research questions, making it partially related to PO7.

CO3: PO7: Analyzing a web page and identifying its elements and attributes involves observational skills and some analytical reasoning, which moderately supports research-related skills, especially in formulating analysis-based questions.

CO4: PO7: Creating web pages using CSS and building dynamic web pages using JavaScript involves some level of inquiry, observation, and analysis during development, moderately contributing to research-related skills.

CO5: PO7: Building dynamic web pages using JavaScript focuses more on applying technical skills than on developing research-based inquiry and analytical methods, making it only partially related to PO7.

CO6: PO7: Repeated practice in building dynamic web pages using JavaScript enhances technical proficiency rather than directly supporting research-related skills, making it partially related to PO7.

CO7: PO7: Acquiring basic concepts of the web and its architecture can involve observational skills and foundational inquiry, which are moderately related to the development of research-related skills as outlined in PO7.

Mapping of PO8 with All CO'S

CO1: PO8: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap requires continuous self-directed learning and adapting to new tools, frameworks, and standards, which aligns strongly with "Learning How to Learn" skills in PO8.

CO2: PO8: Designing dynamic, interactive, and elegant websites involves self-learning of advanced web design techniques and practices, requiring students to independently learn and adapt to evolving web development trends, strongly supporting PO8.

CO3: PO8: Analyzing a web page and identifying its elements and attributes requires some level of independent learning to understand and interpret web development concepts, making it moderately related to PO8.

CO4: PO8: Creating web pages using CSS and building dynamic web pages with JavaScript requires learning various styling and scripting techniques independently, strongly supporting the skills outlined in PO8.

CO5: PO8: Building dynamic web pages using JavaScript involves continual self-learning and adapting to changes in client-side programming practices and libraries, making it strongly related to PO8.

CO6: PO8: Repeated practice in building dynamic web pages using JavaScript requires adapting and learning new features, libraries, or methods, reinforcing independent learning skills, making it strongly related to PO8.

CO7: PO8: Acquiring basic concepts of the web and its architecture involves some self-learning and adapting to new foundational concepts, which moderately supports the skills required in PO8.

Mapping of PO9 with All CO'S

CO1: PO9: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap requires proficiency in digital and technological skills, including the use of various ICT tools and software, making it strongly related to PO9.

CO2: PO9: Designing dynamic, interactive, and elegant websites involves using advanced web development tools and software, demonstrating a high level of digital and technological proficiency, which aligns strongly with PO9.

CO3: PO9: Analyzing a web page and identifying its elements and attributes involves using digital tools to inspect and understand web components, which requires moderate digital and technological skills, making it moderately related to PO9.

CO4: PO9: Creating web pages using CSS and building dynamic web pages with JavaScript involves using various coding tools and environments, demonstrating strong proficiency in digital and technological skills, which strongly aligns with PO9.

CO5: PO9: Building dynamic web pages using JavaScript requires extensive use of ICT tools, debugging software, and other technologies, demonstrating strong digital skills and proficiency, making it strongly related to PO9.

CO6: PO9: Repeated practice in building dynamic web pages using JavaScript further enhances digital skills and the use of various development tools, which strongly supports the requirements of PO9.

CO7: PO9: Acquiring the basic concepts of the web and its architecture involves foundational digital skills and understanding of technological platforms, which moderately relates to the development of digital and technological skills in PO9.

Mapping of PO10 with All CO'S

CO1: PO10: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap focuses on technical skills and does not directly involve multicultural competence or empathy, making it only partially related to PO10.

CO2: PO10: Designing dynamic, interactive, and elegant websites may require considering diverse user experiences and accessibility, but it does not primarily focus on multicultural competence or inclusive spirit, making it partially related to PO10.

CO3: PO10: Analyzing a web page and identifying its elements and attributes involves technical understanding rather than engagement in multicultural settings or demonstrating empathy, making it partially related to PO10.

CO4: PO10: Creating web pages using CSS and building dynamic web pages using JavaScript focuses on technical competencies and does not directly involve leading diverse teams or showing empathy, making it partially related to PO10.

CO5: PO10: Building dynamic web pages using JavaScript is more about technical skills and does not directly connect with multicultural competence, inclusive spirit, or empathy, making it partially related to PO10.

CO6: PO10: Repeated practice in building dynamic web pages using JavaScript focuses on enhancing technical skills rather than multicultural competence or empathy, making it partially related to PO10.

CO7: PO10: Acquiring the basic concepts of the web and its architecture may involve understanding global and diverse perspectives in web accessibility and design, which can moderately contribute to multicultural competence and inclusivity as outlined in PO10.

Mapping of PO11 with All CO'S

CO1: PO11: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves technical skills without a direct focus on ethical values, sustainability, or environmental awareness, making it partially related to PO11.

CO2: PO11: Designing dynamic, interactive, and elegant websites is primarily a technical task and does not directly address value inculcation or environmental awareness, making it partially related to PO11.

CO3: PO11: Analyzing a web page and identifying its elements and attributes focuses on technical analysis rather than on ethical or environmental considerations, making it partially related to PO11.

CO4: PO11: Creating web pages using CSS and building dynamic web pages with JavaScript emphasizes technical development and does not directly relate to ethical values or environmental awareness, making it partially related to PO11.

CO5: PO11: Building dynamic web pages using JavaScript focuses on technical skills rather than addressing ethical issues or promoting environmental conservation, making it partially related to PO11.

CO6: PO11: Repeated practice in building dynamic web pages using JavaScript is centered on technical expertise and does not directly involve value inculcation or environmental concerns, making it partially related to PO11.

CO7: PO11: Acquiring basic concepts of the web and its architecture is foundational and does not directly address ethical values or environmental awareness, making it partially related to PO11.

Mapping of PO12 with All CO'S

CO1: PO12: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves applying knowledge independently and managing web design tasks, demonstrating moderate responsibility and accountability.

CO2: PO12: Designing dynamic, interactive, and elegant websites requires managing various aspects of web development projects independently, which moderately relates to autonomy and accountability in project management.

CO3: PO12: Analyzing a web page and identifying its elements and attributes involves applying analytical skills independently, which moderately supports the demonstration of responsibility and accountability in work contexts.

CO4: PO12: Creating web pages using CSS and building dynamic web pages with JavaScript involves significant project management, independent problem-solving, and accountability for the development process, strongly aligning with PO12.

CO5: PO12: Building dynamic web pages using JavaScript involves managing programming tasks independently and demonstrating responsibility in the development and implementation of features, strongly supporting PO12.

CO6: PO12:Repeated practice in building dynamic web pages using JavaScript requires effective project management, independent work, and accountability, demonstrating strong alignment with PO12.

CO7: PO12: Acquiring basic concepts of the web and its architecture involves self-directed learning and understanding fundamental principles, which moderately relates to autonomy and responsibility in learning contexts.

Mapping of PO13 with All CO'S

CO1: PO13: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap is primarily a technical skill and does not directly involve community engagement or promoting societal well-being, making it partially related to PO13.

CO2: PO13: Designing dynamic, interactive, and elegant websites focuses on technical skills and does not inherently involve community service or engagement, making it partially related to PO13.

CO3: PO13: Analyzing a web page and identifying its elements and attributes is a technical activity with limited direct connection to community engagement or societal impact, making it partially related to PO13.

CO4: PO13: Creating web pages using CSS and building dynamic web pages using JavaScript involves technical work rather than community service or societal well-being, making it partially related to PO13.

CO5: PO13: Building dynamic web pages using JavaScript is focused on technical skills and does not directly contribute to community engagement or societal well-being, making it partially related to PO13.

CO6: PO13: Repeated practice in building dynamic web pages using JavaScript is centered on technical proficiency rather than on community involvement or service, making it partially related to PO13.

CO7: PO13: Acquiring basic concepts of the web and its architecture is foundational knowledge and does not directly involve community service or engagement, making it partially related to PO13

SYLLABUS (CBCS as per NEP 2020) FOR S. Y. B. Sc. (Computer Science) Sem-IV
(w. e. from A.Y. 2024-25)

Name of the Programme	**:** B.Sc (Comp Sci.)
Program Code	**:** USCOS
Class	**:** S.Y.B.Sc (Comp. Sci.)
Semester	IV
Course Type	**:** Minor (PR)
Course Name	**:** Lab Course Based On COS-261-MN (D)
Course Code	**:** COS-262-MN (D)
No. of Lectures	**60**
No. of Credits	**02**

Prerequisites:

- Basic knowledge of computers and its concepts.

Course Objectives:

1: To design web pages using HTML5, CSS, JavaScript and Bootstrap.

2: To design dynamic, interactive and elegant Web sites.

4: To analyze a web page and identify its elements and attributes.

5: To create web pages using Cascading Style Sheets. Build dynamic web pages using JavaScript (Client-side programming).

6: To build dynamic web pages using JavaScript (Client-side programming).

7: To acquire the basic concepts of the Web with reference to its architecture.

Course Outcomes:

CO1: Students will be able to Design web pages using HTML5, CSS, JavaScript and Bootstrap.

CO2: Students will be able to Design dynamic, interactive and elegant Web sites.

CO3: Students will be able to Analyze a web page and identify its elements and attributes.

CO4: Students will be able to Create web pages using Cascading Style Sheets. Build dynamic web pages using JavaScript (Client-side programming).

CO5: Students will be able to build dynamic web pages using JavaScript (Client side Programming).

CO6: Students will be able to Build dynamic web pages using JavaScript (Client side Programming).

CO7: Students will be able to Acquiring the basic concepts of the Web with reference to its architecture.

Sr. No.	Assignment Name	No. of Practical's
1.	Html canvas tag	2
2.	Create CSS form	1
3.	JavaScript Syntax and Structure	2
4.	Variables & Data type	2
5.	JavaScript Conditional Statements	2
6.	JavaScript Loops & Function	2
7.	Implementation of Bootstrap	2
8	Case Study 1	1
9.	Case Study 2	1

Course Outcomes	Programme Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PO 13
CO1	3	3	2	3	3	2	1	3	3	1	1	2	1
CO2	3	3	3	3	3	2	1	3	3	1	1	2	1
CO3	2	2	2	2	2	2	2	2	2	1	1	2	1
CO4	3	3	2	3	3	2	2	3	3	1	1	3	1
CO5	3	3	2	3	3	2	1	3	3	1	1	3	1
CO6	3	3	2	3	3	2	1	3	3	1	1	3	1
CO7	2	1	1	2	2	1	2	2	2	2	1	2	1

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

Justification of Mapping of PO1 with All CO'S

CO1: PO1: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap demonstrates a comprehensive understanding of foundational web development principles, aligning strongly with PO1's focus on fundamental theories and methodologies.
CO2: PO1: Creating dynamic, interactive, and elegant websites requires a profound understanding of advanced web development concepts, which is highly relevant to PO1.

CO3: PO1: Analyzing web pages and identifying their elements and attributes involves applying foundational knowledge, which moderately contributes to a comprehensive understanding of web concepts as outlined in PO1.
CO4: PO1: Creating web pages using Cascading Style Sheets and building dynamic web pages using JavaScript indicates a strong grasp of essential web development techniques, strongly mapping to PO1.
CO5: PO1: Building dynamic web pages using JavaScript showcases the application of client-side programming, demonstrating a solid understanding of programming methodologies, aligning strongly with PO1.
CO6: PO1: Reiterating the building of dynamic web pages using JavaScript emphasizes repeated practice and a strong understanding of client-side programming, making it strongly related to PO1.
CO7: PO1: Acquiring basic web concepts and understanding web architecture provides foundational knowledge, which is moderately related to the comprehensive understanding required in PO1.

Mapping of PO2 with All CO'S

CO1: PO2: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves practical skills and knowledge of industry standards, which are essential for professional tasks, aligning strongly with PO2.
CO2: PO2: Designing dynamic, interactive, and elegant websites requires applying best practices and industry standards, making it highly relevant to PO2.
CO3: PO2: Analyzing a web page and identifying its elements and attributes helps develop procedural knowledge, which is moderately related to acquiring practical and professional skills as described in PO2.
CO4: PO2: Creating web pages using CSS and building dynamic web pages using JavaScript involves hands-on skills and understanding of procedural knowledge and best practices, making it strongly related to PO2.
CO5: PO2: Building dynamic web pages using JavaScript requires practical application of client-side programming skills, aligning strongly with the practical and professional aspects of PO2.
CO6: PO2: Emphasizing repeated practice in building dynamic web pages using JavaScript further demonstrates strong practical expertise, making it highly related to PO2.
CO7: PO2: Acquiring basic concepts of the web and understanding its architecture provides foundational knowledge but only partially contributes to the practical and professional skills focus of PO2.

Mapping of PO3 with All CO'S

CO1: PO3: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap provides technical skills that can help identify business opportunities in web development, moderately contributing to an entrepreneurial mindset.
CO2: PO3: Designing dynamic, interactive, and elegant websites can drive innovation in web solutions and attract business opportunities, making it strongly related to fostering an entrepreneurial mindset.
CO3: PO3: Analyzing web pages and identifying elements and attributes can aid in understanding market dynamics and customer preferences, which moderately supports an entrepreneurial perspective.
CO4: PO3: Creating web pages using CSS and building dynamic web pages using JavaScript encourages innovation in web design, contributing moderately to the entrepreneurial mindset.
CO5: PO3: Building dynamic web pages using JavaScript involves creating interactive features, which can foster innovative thinking and moderate entrepreneurial opportunities.

CO6: PO3: Repeated practice in building dynamic web pages using JavaScript also encourages innovative web solutions, moderately contributing to entrepreneurial knowledge.
CO7: PO3: Acquiring basic concepts of the web and its architecture provides foundational knowledge but only partially supports the development of an entrepreneurial mindset.

Mapping of PO4 with All CO'S

CO1: PO4: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves technical proficiency and problem-solving skills, which are essential specialized competencies relevant to PO4.
CO2: PO4: Designing dynamic, interactive, and elegant websites requires advanced technical skills, creativity, and problem-solving abilities, making it strongly related to the development of specialized skills and competencies.
CO3: PO4: Analyzing web pages to identify elements and attributes develops analytical skills and supports effective communication about web structure, which moderately aligns with PO4.
CO4: PO4: Creating web pages using CSS and building dynamic web pages using JavaScript fosters proficiency in technical skills and the ability to adapt and innovate in web design, making it strongly related to PO4.
CO5: PO4: Building dynamic web pages using JavaScript enhances problem-solving and technical skills, demonstrating strong alignment with the specialized competencies in PO4.
CO6: PO4: Repeated practice in building dynamic web pages using JavaScript further solidifies technical skills and adaptability, strongly contributing to PO4.
CO7: PO4: Acquiring basic concepts of the web and its architecture provides foundational knowledge that supports analytical abilities and technical communication, moderately related to PO4.

Mapping of PO5 with All CO'S

CO1: PO5: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves applying learned concepts and solving practical problems in web development, demonstrating strong analytical reasoning and creativity, which aligns strongly with PO5.
CO2: PO5: Designing dynamic, interactive, and elegant websites requires applying critical thinking and creativity to solve complex design and user experience challenges, making it strongly related to PO5.
CO3: PO5: Analyzing web pages to identify elements and attributes requires critical thinking and analytical reasoning, which moderately supports the capacity for problem-solving as outlined in PO5.
CO4: PO5: Creating web pages using CSS and building dynamic web pages using JavaScript involves solving technical problems and applying web development concepts in practical scenarios, strongly aligned with PO5.
CO5: PO5: Building dynamic web pages using JavaScript showcases the ability to solve client-side programming challenges, demonstrating strong application and problem-solving skills, which are core to PO5.
CO6: PO5: Repeated practice in building dynamic web pages using JavaScript further enhances problem-solving, adaptability, and readiness to tackle complex programming challenges, making it strongly related to PO5.
CO7: PO5: Acquiring basic concepts of the web and its architecture provides foundational knowledge that supports problem-solving and analytical reasoning, making it moderately related to PO5.

Mapping of PO6 with All CO'S

CO1: PO6: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap requires the ability to communicate technical concepts clearly and effectively, both orally and in writing, but collaboration is not a primary focus, making it moderately related to PO6.
CO2: PO6: Designing dynamic, interactive, and elegant websites often involves teamwork and collaboration, and it requires clear communication of design ideas and technical specifications, making it moderately related to PO6.
CO3: PO6: Analyzing a web page and identifying its elements and attributes involves explaining technical details and findings, which requires communication skills. This outcome moderately supports PO6.
CO4: PO6: Creating web pages using CSS and building dynamic web pages with JavaScript involves explaining the development process, which requires good communication skills. However, it only moderately relates to collaboration aspects of PO6.
CO5: PO6: Building dynamic web pages using JavaScript may require collaborating with peers or team members, and effectively communicating the web functionalities, making it moderately related to PO6.
CO6: PO6: Repeated practice in building dynamic web pages involves communication of progress and collaborative problem-solving, but the primary focus is still technical skills rather than communication, making it moderately related to PO6.
CO7: PO6: Acquiring basic concepts of the web and its architecture involves foundational knowledge. While some communication is needed to convey these concepts, it is only partially related to developing strong communication skills or collaborative efforts.

Mapping of PO7 with All CO'S

CO1: PO7: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves applying technical skills rather than focusing on research-related skills such as inquiry, data collection, and analysis, making it only partially related to PO7.
CO2: PO7: Designing dynamic, interactive, and elegant websites requires some level of observation and creativity but does not directly focus on research methodologies or formulating research questions, making it partially related to PO7.
CO3: PO7: Analyzing a web page and identifying its elements and attributes involves observational skills and some analytical reasoning, which moderately supports research-related skills, especially in formulating analysis-based questions.
CO4: PO7: Creating web pages using CSS and building dynamic web pages using JavaScript involves some level of inquiry, observation, and analysis during development, moderately contributing to research-related skills.
CO5: PO7: Building dynamic web pages using JavaScript focuses more on applying technical skills than on developing research-based inquiry and analytical methods, making it only partially related to PO7.
CO6: PO7: Repeated practice in building dynamic web pages using JavaScript enhances technical proficiency rather than directly supporting research-related skills, making it partially related to PO7.
CO7: PO7: Acquiring basic concepts of the web and its architecture can involve observational skills and foundational inquiry, which are moderately related to the development of research-related skills as outlined in PO7.

Mapping of PO8 with All CO'S

CO1: PO8: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap requires continuous self-directed learning and adapting to new tools, frameworks, and standards, which aligns strongly with "Learning How to Learn" skills in PO8.

CO2: PO8: Designing dynamic, interactive, and elegant websites involves self-learning of advanced web design techniques and practices, requiring students to independently learn and adapt to evolving web development trends, strongly supporting PO8.

CO3: PO8: Analyzing a web page and identifying its elements and attributes requires some level of independent learning to understand and interpret web development concepts, making it moderately related to PO8.

CO4: PO8: Creating web pages using CSS and building dynamic web pages with JavaScript requires learning various styling and scripting techniques independently, strongly supporting the skills outlined in PO8.

CO5: PO8: Building dynamic web pages using JavaScript involves continual self-learning and adapting to changes in client-side programming practices and libraries, making it strongly related to PO8.

CO6: PO8: Repeated practice in building dynamic web pages using JavaScript requires adapting and learning new features, libraries, or methods, reinforcing independent learning skills, making it strongly related to PO8.

CO7: PO8: Acquiring basic concepts of the web and its architecture involves some self-learning and adapting to new foundational concepts, which moderately supports the skills required in PO8.

Mapping of PO9 with All CO'S

CO1: PO9: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap requires proficiency in digital and technological skills, including the use of various ICT tools and software, making it strongly related to PO9.

CO2: PO9: Designing dynamic, interactive, and elegant websites involves using advanced web development tools and software, demonstrating a high level of digital and technological proficiency, which aligns strongly with PO9.

CO3: PO9: Analyzing a web page and identifying its elements and attributes involves using digital tools to inspect and understand web components, which requires moderate digital and technological skills, making it moderately related to PO9.

CO4: PO9: Creating web pages using CSS and building dynamic web pages with JavaScript involves using various coding tools and environments, demonstrating strong proficiency in digital and technological skills, which strongly aligns with PO9.

CO5: PO9: Building dynamic web pages using JavaScript requires extensive use of ICT tools, debugging software, and other technologies, demonstrating strong digital skills and proficiency, making it strongly related to PO9.

CO6: PO9: Repeated practice in building dynamic web pages using JavaScript further enhances digital skills and the use of various development tools, which strongly supports the requirements of PO9.

CO7: PO9: Acquiring the basic concepts of the web and its architecture involves foundational digital skills and understanding of technological platforms, which moderately relates to the development of digital and technological skills in PO9.

Mapping of PO10 with All CO'S

CO1: PO10: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap focuses on technical skills and does not directly involve multicultural competence or empathy, making it only partially related to PO10.

CO2: PO10: Designing dynamic, interactive, and elegant websites may require considering diverse user experiences and accessibility, but it does not primarily focus on multicultural competence or inclusive spirit, making it partially related to PO10.

CO3: PO10: Analyzing a web page and identifying its elements and attributes involves technical understanding rather than engagement in multicultural settings or demonstrating empathy, making it partially related to PO10.

CO4: PO10: Creating web pages using CSS and building dynamic web pages using JavaScript focuses on technical competencies and does not directly involve leading diverse teams or showing empathy, making it partially related to PO10.

CO5: PO10: Building dynamic web pages using JavaScript is more about technical skills and does not directly connect with multicultural competence, inclusive spirit, or empathy, making it partially related to PO10.

CO6: PO10: Repeated practice in building dynamic web pages using JavaScript focuses on enhancing technical skills rather than multicultural competence or empathy, making it partially related to PO10.

CO7: PO10: Acquiring the basic concepts of the web and its architecture may involve understanding global and diverse perspectives in web accessibility and design, which can moderately contribute to multicultural competence and inclusivity as outlined in PO10.

Mapping of PO11 with All CO'S

CO1: PO11: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves technical skills without a direct focus on ethical values, sustainability, or environmental awareness, making it partially related to PO11.

CO2: PO11: Designing dynamic, interactive, and elegant websites is primarily a technical task and does not directly address value inculcation or environmental awareness, making it partially related to PO11.

CO3: PO11: Analyzing a web page and identifying its elements and attributes focuses on technical analysis rather than on ethical or environmental considerations, making it partially related to PO11.

CO4: PO11: Creating web pages using CSS and building dynamic web pages with JavaScript emphasizes technical development and does not directly relate to ethical values or environmental awareness, making it partially related to PO11.

CO5: PO11: Building dynamic web pages using JavaScript focuses on technical skills rather than addressing ethical issues or promoting environmental conservation, making it partially related to PO11.

CO6: PO11: Repeated practice in building dynamic web pages using JavaScript is centered on technical expertise and does not directly involve value inculcation or environmental concerns, making it partially related to PO11.

CO7: PO11: Acquiring basic concepts of the web and its architecture is foundational and does not directly address ethical values or environmental awareness, making it partially related to PO11.

Mapping of PO12 with All CO'S

CO1: PO12: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap involves applying knowledge independently and managing web design tasks, demonstrating moderate responsibility and accountability.

CO2: PO12: Designing dynamic, interactive, and elegant websites requires managing various aspects of web development projects independently, which moderately relates to autonomy and accountability in project management.

CO3: PO12: Analyzing a web page and identifying its elements and attributes involves applying analytical skills independently, which moderately supports the demonstration of responsibility and accountability in work contexts.

CO4: PO12: Creating web pages using CSS and building dynamic web pages with JavaScript involves significant project management, independent problem-solving, and accountability for the development process, strongly aligning with PO12.

CO5: PO12: Building dynamic web pages using JavaScript involves managing programming tasks independently and demonstrating responsibility in the development and implementation of features, strongly supporting PO12.

CO6: PO12:Repeated practice in building dynamic web pages using JavaScript requires effective project management, independent work, and accountability, demonstrating strong alignment with PO12.

CO7: PO12: Acquiring basic concepts of the web and its architecture involves self-directed learning and understanding fundamental principles, which moderately relates to autonomy and responsibility in learning contexts.

Mapping of PO13 with All CO'S

CO1: PO13: Designing web pages using HTML5, CSS, JavaScript, and Bootstrap is primarily a technical skill and does not directly involve community engagement or promoting societal well-being, making it partially related to PO13.

CO2: PO13: Designing dynamic, interactive, and elegant websites focuses on technical skills and does not inherently involve community service or engagement, making it partially related to PO13.

CO3: PO13: Analyzing a web page and identifying its elements and attributes is a technical activity with limited direct connection to community engagement or societal impact, making it partially related to PO13.

CO4: PO13: Creating web pages using CSS and building dynamic web pages using JavaScript involves technical work rather than community service or societal well-being, making it partially related to PO13.

CO5: PO13: Building dynamic web pages using JavaScript is focused on technical skills and does not directly contribute to community engagement or societal well-being, making it partially related to PO13.

CO6: PO13: Repeated practice in building dynamic web pages using JavaScript is centered on technical proficiency rather than on community involvement or service, making it partially related to PO13.

CO7: PO13: Acquiring basic concepts of the web and its architecture is foundational knowledge and does not directly involve community service or engagement, making it partially related to PO13.

SYLLABUS (CBCS as per NEP 2020) FOR S. Y. B. Sc. (Computer Science) Sem-IV
(w. e. from A.Y. 2024-25)

Name of the Programme : B.Sc. Computer Science
Program Code : USCOS
Class : S.Y.B.Sc. (Computer Science)
Semester IV
Course Type : Major (PR)
Course Name : Lab Course Based on COS-253-MJM
Course Code : COS-276-SEC
No. of Lectures 30
No. of Credits 02

Course Objectives:

1. To learn Object Oriented Programming language.
2. To Read Input from users by different ways.
3. To define classes with different access modifiers.
4. To handle complex problems using object-oriented concepts.
5. To handle abnormal termination of a program using exception handling.
6. To handle string using String &String Buffer Class.
7. To understand file handling using java.

Course Outcomes: On completion of the course, student will be able to

CO1. On completion of the course, student will be able to Understand Object Oriented Concepts
CO2. Understand the difference between Java & CPP
CO3. Read input from different ways.
CO4. Define class with different access modifiers and create object.
CO5. Write real world problems using Java
CO6. Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming.
CO7. Demonstrate the use of various OOPs concepts with the help of programs.

Sr. No	Assignment Name	No. of Practicals
1	Java Tools	**1**
2	Array of Objects	**2**
3	Packages	**2**
4	Single Inheritance	**1**
5	Multilevel Inheritance	**1**
6	Interfaces	**2**
7	Exception Handling and Assertions	**2**
8	Input Output	**2**
9	File Handling	**2**

References:

1) Complete reference Java by Herbert Schildt (5th edition)
2) Java 2 programming black books, Steven Horlzner
3) Programming with Java , A primer ,Forth edition , By E. Balagurusamy
4) Core Java Volume-I-Fundamentals, Eighth Edition, Cay S. Horstmann, Gary Cornell, Prentice Hall, Sun Microsystems Press

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

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

Mapping of PO1 With All CO's with Justification :

CO1: With PO1: Object-oriented concepts are foundational to programming languages andsoftware development, contributing to the broader knowledge areas mentioned in PO1.

CO2: With PO1: Understanding the difference between Java and C++ is language-specific and may not directly contribute to the comprehensive knowledge enrichment across diverseIT domains listed in PO1.

CO3: With PO1: Reading input is a basic programming skill, but it may not directly alignwith the specified knowledge areas in PO1.

CO4: With PO1: Creating classes with access modifiers and instantiating objects are fundamental OOP concepts that contribute to understanding programming languages, thoughnot as directly aligned with the diverse IT domains in PO1.

CO5: With PO1: Writing real-world problems in Java is specific to programming and contributes to knowledge in programming languages, but it may not directly cover the widerange of IT domains listed in PO1.

CO6: WithPO1: Understanding inheritance and related concepts contributes to programmingknowledge, though it may not directly encompass the broad range of IT domains in PO1.

CO7: With PO1 : Demonstrating OOPs concepts through programs is specific to programming and contributes to knowledge in programming languages, though it may notdirectly cover all IT domains in PO1.

Mapping of PO2 With All CO's with Justification :

CO1: WithPO2 :A strong understanding of Object Oriented Concepts is

fundamental tocomprehending various dimensions of software application and project development.
CO2: WithPO2 : Understanding the differences between Java and C++ is language-specificand may not be directly tied to grasping all dimensions of software application

and project concepts.
CO3: With PO2 : Reading input is a basic programming skill but may not directly contributeto a comprehensive understanding of all dimensions of software application and project concepts.
CO4: With PO2 : Defining classes with access modifiers and creating objects contributes to afoundational understanding of software development but may not cover all dimensions of software applications and projects.
CO5: WithPO2 : Writing real-world problems in Java is specific to programming andcontributes to understanding software development, but it may not directly cover all dimensions of software applications and projects.
CO6: With PO2 : Understanding inheritance and related concepts is crucial for a comprehensive grasp of various dimensions within software application and projectdevelopment.
CO7: With PO2 : Demonstrating OOPs concepts through programs is directly aligned with practical applications and contributes to a deep understanding of multiple dimensions withinsoftware application and project development.

Mapping of PO3 With All CO's with Justification :

CO1: With PO3 :Demonstrating Object Oriented Concepts with the use of ICT aligns withthe goal of understanding computer subjects through practical applications.
CO2: WithPO3 :Understanding the difference between Java and CPP is relevant to computersubjects, and demonstrating this knowledge through ICT usage contributes to a practical understanding.
CO3: WithPO3 :Reading input using various methods is a programming skill that, when demonstrated through ICT, contributes to the practical understanding of computer subjects.CO4: With PO3 : Defining classes with access modifiers and creating objects, when demonstrated using ICT, enhances the practical understanding of computer subjects, especially in programming.
CO5: WithPO3 : Writing real-world problems in Java and demonstrating these programs withICT aligns with the goal of understanding computer subjects through practical application.
CO6: WithPO3 :Classifying inheritance and related concepts with ICT-based demonstrations enhances the practical understanding of computer subjects, combining theoretical knowledgewith hands-on application.
CO7: WithPO3 : Demonstrating the use of OOPs concepts through programs with the help ofICT aligns with the overall goal of understanding computer subjects through practical applications.

Mapping of PO4 With All CO's with Justification :

CO1: With PO4 :A strong understanding of Object Oriented Concepts is essential for

developing in-house applications, forming the foundation for effective software design andimplementation.
CO2: WithPO4 : Understanding the difference between Java and CPP can be relevant to choosing the appropriate programming language for in-house applications, contributing toinformed decision-making in project development.
CO3: WithPO4 :Reading input from different sources is a fundamental skill in programming,contributing to the ability to handle diverse input scenarios when developing in-house applications.
CO4: With PO4: Defining classes with various access modifiers and creating objects is crucial for structuring and implementing in-house applications in an organized and efficientmanner.
CO5: With PO4: Writing real-world problems using Java is directly applicable to developing in-house applications, demonstrating the practical implementation of programming concepts in a project setting.
CO6: WithPO4 :Classifying inheritance and related concepts is vital for designing the architecture of in-house applications, ensuring efficient code organization and maintenance.CO7: WithPO4 : Demonstrating OOPs concepts through programs is directly aligned with developing in-house applications, showcasing the practical application of theoretical knowledge in project scenarios.

Mapping of PO5 With All CO's with Justification :

CO1: With PO5 : Interacting with IT experts during visits may provide insights into real-worldapplications of Object Oriented Concepts, enhancing understanding beyond theoretical knowledge.
CO2: With PO5 : Interacting with IT experts during visits can offer opportunities to discussand understand the practical implications of choosing between Java and CPP in real-worldscenarios.
CO3: With PO5 : Interacting with IT experts during visits may not be directly tied to the skillof reading input from different ways, as this is more focused on programming skills.
CO4: With PO5 : Interacting with IT experts during visits may provide insights into the practical aspects of defining classes with various access modifiers and creating objects inreal-world projects.
CO5: WithPO5 : Interacting with IT experts during visits may involve discussions on real- world problems and their solutions using Java, contributing to practical insights into projectdevelopment.
CO6: With PO5 :Interacting with IT experts during visits may offer opportunities to discuss and understand the practical aspects of inheritance, binding, exception handling, and genericprogramming in real-world projects.
CO7: WithPO5 :Interacting with IT experts during visits may involve demonstrating OOPsconcepts in practical scenarios, providing insights into their application in real-world projects.

Mapping of PO6 With All CO's with Justification :

CO1: With PO6 : The industrial internship provides practical exposure, allowing students toapply and deepen their understanding of Object Oriented Concepts in real-

world IT projects.

CO2: WithPO6 :The industrial internship offers an opportunity to gain firsthand experience in the IT industry, allowing students to understand and potentially work with both Java and CPP, contributing to a practical understanding of their differences.

CO3: With PO6 : While the industrial internship may involve various tasks, including readinginput from different sources, it may not be the primary focus, making it moderately related to the skill of reading input.

CO4: With PO6 : The industrial internship allows students to actively participate in definingclasses with access modifiers and creating objects, contributing to their practical skills in software development.

CO5: With PO6: The industrial internship involves working on real-world problems, providing an excellent opportunity for students to apply their Java programming skills inpractical scenarios.

CO6: With PO6 : The industrial internship allows students to classify inheritance and understand its applications, as well as gain practical experience in early and late binding,exception handling, and generic programming.

CO7: WithPO6 : The industrial internship provides a platform for students to actively demonstrate the application of various OOPs concepts through real-world programmingprojects in an industry setting.

Mapping of PO7 With All CO's with Justification:

CO1: With PO7 :A strong understanding of Object Oriented Concepts is a key employabilityfactor in the IT industry, aligning with the goal of making students employable.

CO2: WithPO7 :Understanding the differences between Java and CPP is relevant to the employability of students, as it enables them to adapt to the technology demands of the ITindustry.

CO3: WithPO7 : Reading input from different sources is a fundamental skill, contributing toemployability by enhancing adaptability to diverse data sources in the IT industry.

CO4: WithPO7 :The ability to define classes with various access modifiers and create objectsis a practical skill highly valued in the IT industry, enhancing employability.

CO5: WithPO7 : Writing real-world problems using Java reflects practical application skills,making students more employable in the IT industry where problem-solving is crucial.

CO6: With PO7 : Understanding inheritance, early and late binding, exception handling, andgeneric programming contributes to students' employability by equipping them with advanced programming skills.

CO7: With PO7: Actively demonstrating the use of OOPs concepts through programsshowcases practical proficiency, making students more employable in the IT industry.

SYLLABUS (CBCS as per NEP 2020) FOR S. Y. B. Sc. (Computer Science) Sem-IV
(w. e. from A.Y. 2024-25)

Name of the Programme	**:** B.Sc. Computer Science
Program Code	**:** USCOS
Class	**:** Arts and Commerce Faculty
Semester	IV
Course Type	**:** Open Elective (TH)
Course Name	**:** Basic Tools of Digital Marketing
Course Code	**:** COS-216-OE
No. of Lectures	**:** 30
No. of Credits	**:** 2

Course Objective:

1. To understand the basic knowledge of Digital Marketing
2. To understand the Social Media Marketing.
3. To create a digital marketing posters with help of Canva.
4. To generate an average report based on the Digital Marketing.
5. To understand the how to reach customers.

Course outcomes:

CO1 -Demonstrate the Canva application for designing posters.

CO2 -Demonstrate of Google Analytics.

CO3 -Identify and utilize various tools such as social media etc.

CO4 -Understand how to create and run digital media based campaigns

CO5 -Articulate innovative insights of digital marketing enabling a competitive edge.

CO6 -Understand the concept of digital marketing and its real-world iterations

CO7 -Explain the key digital marketing activities needed for competitive success

Units	Title & Content	No. of lectures
Unit-1	**Digital Marketing** • Introduction of Digital Marketing, Social Media PlatformsSearch Engine Optimization. • Google Analytics	10
Unit-2	**Design** • Canva application (Using related various application • Poster Design • Search Engine Marketing	10
Unit-3	**Way of Digital Marketing** • Facebook Marketing • Instagram Marketing • YouTube Marketing • E-Mail Marketing	10

Mapping of this course with Programme Outcomes

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

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

Justification of PO1 to ALL COs:
Canva usage requires basic design principles and knowledge, which contributes to comprehensive learning. Understanding Google Analytics involves strong analytical skills, supporting comprehensive knowledge.

Justification of PO2 to ALL COs:
Mastering Canva is highly practical, offering tangible skills for professional digital design work. Google Analytics is a core tool in digital marketing, essential for analyzing data in a professional setting.

Justification of PO3 to ALL COs:
Proficiency in social media tools is a crucial part of professional and procedural knowledge in marketing. Practical understanding of running campaigns directly relates to professional marketing practices.

Justification of PO4 to ALL COs:
Though innovation is important, it is less procedural and more strategic in nature. Real-world application of digital marketing concepts is highly relevant to procedural and professional skills
Justification of PO5 to ALL COs:
Canva helps in applying design knowledge, but the problem-solving aspect is limited to creative challenges. Identifying appropriate tools involves critical application and problem-solving based on marketing needs.
Justification of PO6 to ALL COs:
Identifying appropriate tools involves critical application and problem-solving based on marketing needs. Innovation in marketing directly involves applying insights to solve competitive challenges.
Justification of PO7 to ALL COs:
Knowledge of core activities is crucial for solving business problems and achieving success. Understanding real-world applications is vital for problem-solving and the practical application of concepts.
Justification of PO8 to ALL COs:
Learning Canva involves self-directed learning and mastering new tools, but is somewhat limited to design. Google Analytics requires continual learning and adapting to new data-driven insights, fostering analytical learning.
Justification of PO9 to ALL COs:
Exploring and adapting to a variety of social media tools fosters independent learning and flexibility. Running campaigns involves experiential learning and problem-solving, which builds adaptive learning skills.
Justification of PO10 to ALL COs:
Innovation requires an open mindset and learning from new trends and competitive landscapes. Learning to apply core digital marketing concepts in real-world scenarios fosters continuous learning.
Justification of PO11 to ALL COs:
While useful for business, Google Analytics does not directly engage with value inculcation or environmental awareness. Social media platforms can be used to promote values and environmental causes, depending on the campaigns designed
Justification of PO12 to ALL COs:
Innovative strategies can incorporate value-driven elements like social responsibility or sustainability. Digital marketing concepts can include sustainable and ethical marketing practices, fostering awareness.
Justification of PO13 to ALL COs:
Focuses on competitive success but doesn't inherently include value inculcation or environmental awareness.

SYLLABUS (CBCS as per NEP 2020) FOR S. Y. B. Sc. (Computer Science) Sem-IV
(w. e. from A.Y. 2024-25)

Name of the Programme	**:** B.Sc. Computer Science
Programme Code	**:** USCOS
Class	**:** S.Y.B.Sc (Comp. Sci.)
Semester	IV
Course Type	**:** Project
Course Code	**:** COS-285-CEP
Course Title	**:** Community Engagement Project
No. of Credits	02
No. of Teaching Hours	60

Course Objective:

1. To develop students ability to design and implement effective research questionnaires for Community-based studies.
2. To enhance students skills in collecting and analyzing socio-economic and environmental data.
3. To foster critical thinking and problem-solving through real-world research.
4. To deepen understanding of the relationship between human activities.
5. To promote active engagement with local communities to address research issues.
6. To build students competence in synthesizing and presenting research findings.
7. To prepare students for advanced academic research or professional roles in related fields.

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

CO1: Demonstrate the ability to design and implement effective research questionnaires for community-based studies.
CO2: Exhibit enhanced skills in collecting and analyzing research data.
CO3: Apply critical thinking and problem-solving skills in conducting real-world research.
CO4: Display a deeper understanding of the relationship between human activities.
CO5: Actively engage with local communities to address and resolve issues.
CO6: Demonstrate competence in synthesizing and presenting research findings clearly and effectively.
CO7: Prepare for advanced academic research or professional roles in related fields.

SOP for the Field Project

As per the NEP-2020 credit and course structure, students in UG programs are required to complete a two-credit Field Project in SYBA Semester III to be eligible for the award of a B.A. degree. to meet this requirement, our Board of Studies has prepared a Standard Operating Procedure (SOP) and format for conducting the Field Project. The detailed SOPs are provided below.

1. Preparation of SOP and Course Material:
The Board of Studies (BOS) will prepare the SOP, project format, and curriculum for the Field Project coursework.

2. Notification to Students:
The department will issue a notice instructing students to attend the coursework for the Field Project.

3. Conducting Coursework:
The department will conduct the necessary coursework to prepare students for undertaking the Field Project.

4. Application for Guide Allocation:
Groups of three students will submit an application in the prescribed format to the HOD for the allocation of a Field Project guide.

5. Guide Allocation:
A departmental committee will allocate guides to students in accordance with the department's rules and policies.

6. Publication of list of students and guide:
The list of student groups and their allotted guides will be published.

7. Topic Finalization:
Students will meet with their assigned guide to finalize the topic of their Field Project.

8. Questionnaire Development:
Students will prepare a questionnaire under the guidance of their Field Project guide.

9. Fieldwork and Data Collection:
Students will conduct fieldwork/field surveys to collect relevant data and information.

10. Data Analysis and Presentation:
Students will analyze and present the collected data.

11. Project Preparation:
Students will prepare the Field Project report in the prescribed format provided by the department, under the guidance of their assigned guide.

12. Assessment and Evaluation:
The Field Project will be assessed and evaluated according to the guidelines provided by the exam department.

13. Inclusion of Geo-tagged Photographs:
The Field Project must include geo-tagged photographs of the fieldwork/survey.

14. Inclusion of Study Area Map:
The Field Project should contain a map of the study area.

15. Project Length:
The Field Project report should be between 20 to 25 pages

Topics and Learning Points

Unit 1: Planning and Preparation for Field Work	**Teaching Hours**
1.1 Defining the Fieldwork Topic	**15**
1.2 Scope of the Study Area	
1.3 Identifying Key Research Questions for Field Study	
1.4 Understanding the Fieldwork Objectives	
1.5 Ethical Considerations in Field Work	
1.6 Creating a Fieldwork Plan	
Unit 2: Fieldwork Data Collection	**25**
2.1 Selecting the Fieldwork Methods (Surveys, Interviews, Observations)	
2.2 Collecting Primary Data from the Field	
2.3 Recording and Organizing Field Data (Photographs, Maps, Notes)	
2.4 Handling Challenges in Data Collection	
2.5 Post-Fieldwork Data Compilation and Preliminary Analysis	
Unit 3: Fieldwork Report Preparation and Presentation	**20**
3.1 Analyzing Field Data (Quantitative and Qualitative Methods)	
3.2 Structuring the Fieldwork Report	
3.3 Writing the Introduction and Study Area Description	
3.4 Formulating Objectives and Hypothesis	
3.5 Writing the Methodology and Data Analysis Sections	
3.6 Discussing Results and Significance of Findings	
3.7 Conclusion and Recommendations	
3.8 Bibliography and References	
3.9 Preparing for Oral Presentation of the Report	
3.10 Submission of the Final Fieldwork Report	

References:

Adams, J., Khan, H. T. A., Raeside, R. & White, D. (2007).Research methods for graduatebusiness and social science students. New Delhi: Response Books. (C)
Ahmeed, Najma Perveen (2002).Research Methods in Indian music (2nd ed.).New Delhi:Manohar Publication & distributors. (C)
Alston, M. & Bowles, W.(2003). Research for social workers: an introduction to methods (2nded.). New Delhi: Rawat. (C)
Angrosino, M. (2007). Doing ethnographic and observational research. Los Angeles: SagePublications. (C)

Course Outcomes	Program Outcome									
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	2	3	2	3	2	2	3	2	3	2
CO2	3	2	2	3	3	3	2	2	3	2
CO3	3	2	2	3	2	3	2	2	3	2
CO4	3	2	2	2	3	3	2	2	2	3
CO5	2	3	3	2	3	2	3	2	2	3
CO6	3	3	2	3	2	3	2	2	3	2
CO7	3	2	2	3	2	3	2	2	3	2

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

PO1: Critical and Creative Thinking all COs demonstrate a strong alignment with critical thinking (CO1, CO2, CO3, CO4). The design of questionnaires (CO1), analysis of socio-economic data (CO2), and application of problem-solving skills in research (CO3) require analytical and creative thought processes to assess real-world problems.

PO2: Communication Skills
Communication is integral to most COs, especially CO1 (designing questionnaires) and CO6(presentation of research findings), where clear expression of complex data and ideas is essential. Engaging with communities (CO5) also requires strong verbal and written communication.

PO3: Multicultural Competence CO5 (community engagement) and CO3 (understanding diverse socio-cultural impacts) directly engage with the values of multicultural competence, allowing students to work with and understand diverse groups and geographical contexts.

PO4: Research Skills All COs, especially CO1, CO2, and CO6, focus on research skills. Designing questionnaires, collecting and analyzing data, and synthesizing findings require rigorous research methodologies, in line with PO4's focus on hypothesis testing, data interpretation, and project design.

PO5: Environmental Awareness Environmental awareness is strongly linked to CO2 (collecting and analyzing environmental data) and CO4 (understanding human geography relationships), where students study the impact of human activities on the environment and work towards sustainability.

PO6: Problem-solving Abilities CO3 (critical thinking) and CO5 (engaging with communities to resolve issues) contribute to problem-solving abilities, as students identify geographical issues and propose solutions through innovative methods.

PO7: Collaboration and Teamwork CO5 emphasizes teamwork through community engagement, where students collaborate with local populations to address geographical issues. CO1 (questionnaire design) and CO2 (data collection) also involve working in teams for effective outcomes.

PO8: Value Inculcation many COs, particularly CO5 (community engagement), focus on ethical engagement with communities and understanding the broader implications of geographical research on human well-being and environmental sustainability.

PO9: Digital and Technological Skills CO1 (questionnaire design), CO6 (data presentation), and CO2 (data analysis) align with digital skills, as students utilize tools like GIS, data processing software, and digital platforms to conduct and present their research effectively.

PO10: Community Engagement and Service CO5 directly engages with this PO by focusing on community-based studies and working with local populations to address geographical and environmental issues, fostering a sense of responsibility and service.