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 –III

For Department of Computer Science

Tuljaram Chaturchand College, Baramati

Choice Based Credit System Syllabus (2024 Pattern)

(As Per NEP 2020)

To be implemented from Academic Year 2025-2026

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

Preamble

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

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

A degree in Computer Science subject equips students with the knowledge and skills necessary for a diverse range of fulfilling career paths. Career in Computer Science is considered one of the most high-paying jobs and is full of opportunities; particularly when India's prowess in information technology industry is recognized across the globe. The pool

of talented computer professionals working in IT companies of the USA, Canada and other countries shows that IT can take a person to higher levels. Numerous IT companies from India employ huge number of computer professionals in their Indian and overseas offices. Students who are interested in programming**,** software development, and have good analytical and reasoning skills may pursue this course. Job opportunities are available for Graduates and Post Graduates in Government as well as Private sector. Graduates may take up the following job posts- Software Engineer, Software Tester, Data Analyst, Project Manager, Network Administrator, Database Administrator and Application Developer.

Overall, revising the Computer Science syllabus in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

Programme Outcomes (POs)
for
B.Sc. (Computer Science)

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

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

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

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

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

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

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

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

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

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

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

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

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

Programme Specific Outcomes (PSOs)
for
B.Sc. (Computer Science)

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

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

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

PSO4: Prepare for continued professional development.

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

PSO6: Develop proficiency in the practice of computing.

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

Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Empowered Autonomous)

Board of Studies (BOS) in Computer Science

(Academic Year 2025-26 to 2027-28)

Sr.No.	Name of Member	Designation
1.	**Dr. Choudhari Upendra Durgadas**	**Chairperson**
2.	**Dr. Kardile Vilas Vasantrao**	Member
3.	**Mr. Mankar Abhijeet Dnyaneshwar**	Member
4.	**Ms. Kulkarni Prajakta Pankaj**	Member
5.	**Ms. Bhagat Asmita Amol**	Member
6.	**Mr. Shah Rahul Adesh**	Member
7.	**Mr. Dixit Purushottam Suresh**	Member
8.	**Ms. Londhe Kalyani Waman**	Member
9.	**Ms. Swami Poornima Chandrashekhar**	Member
10.	**Ms. Theurkar Komal Manoj**	Member
11.	**Mr. Chemte Swapnil Pandurang**	Member
12.	**Ms. Attar Naziya Shahabuddin**	Member
13.	**Ms. Gharge J. P.**	Member
14.	**Ms. Shivarkar V. K.**	Member
15.	**Dr. Manisha Bharambe**	Vice-Chancellor Nominee Subject Expert from SPPU, Pune
16.	**Dr. Bhoite Sudhakar D.**	Subject Expert from Outside the Parent University
17.	**Dr. Patki Ulhas S.**	Subject Expert from Outside the Parent University
18.	**Mr. Yadav Preetam**	Representative from industry/corporate sector/allied areas
19.	**Mr. Bhaskar Ranaware**	Member of the College Alumni
20.	**Ms. Sakshi Vargar**	UG Student Representative
21.	**Mr. Adesh Jagtap**	PG Student Representative

Credit Distribution Structure for Three/Four Year Honours/Honours with Research Degree Programme
With Multiple Entry and Exit options as per National Education Policy (2024 Pattern as per NEP-2020)

Level/ Difficulty	Sem	Subject DSC-1				Subject DSC-2	Subject DSC-3	GE/OE	SEC	IKS	AEC	VEC	CC	Total
4.5/100	I	2(T)+2(P)				2(T)+2(P)	2(T)+ 2(P)	2(T)	2 (T/P)	2(T) (Generic)	2(T)	2(T)	--	22
	II	2(T)+2(P)				2(T)+2(P)	2(T)+2(P)	2(P)	2 (T/P)	--	2(T)	2(T)	2(T	22
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 **Continue option**: Student will select one subject among the (subject 1, subject 2 and subject 3) as major and other as minor and third subject will be dropped.														
Level/ Difficulty	**Sem**	**Credits Related to Major**				**Minor**	--	**GE/OE**	**SEC**	**IKS**	**AEC**	**VEC**	**CC**	**Total**
		Major Core	**Major Elective**	**VSC**	**FP/OJT/CEP/ RP**									
5.0/200	III	4(T)+2(P)	--	2 (T/P)	2(FP)	2(T)+2(P)	--	2(T)	--	2(T)	2(T)	--	2(T)	22
	IV	4(T)+2(P)	--	2 (T/P)	2(CEP)	2(T)+2(P)	--	2(P)	2 (T/P)	--	2(T)	--	2(T)	22
Exit option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4credits core NSQF course/Internship OR Continue with Major and Minor														
5.5/300	V	8(T)+4(P)	2(T)+2(P)	2 (T/P)	2(FP/CEP)	2(T)	--	--	--	--	--	--	--	22
	VI	8(T)+4(P)	2(T)+2(P)	2 (T/P)	4 (OJT)	--	--	--	--	--	--	--	--	22
Total 3Years		**44**	**8**	**8**	**10**	**18**	**8**	**8**	**6**	**4**	**8**	**4**	**6**	**132**
Exit option: Award of **UG Degree in Major** with 132 credits OR Continue with Major and Minor														
6.0/400	VII	6(T)+4(P)	2(T)+2 (T/P)	--	4(RP)	4(RM)(T)	--	--	--	--	--	--	--	22
	VIII	6(T)+4(P)	2(T)+2 (T/P)	--	6(RP)	--	--	--	--	--	--	--	--	22
Total 4Years		**64**	**16**	**8**	**22**	**22**	**8**	8	**6**	**4**	**8**	**4**	**6**	**176**
Four Year **UG Honours with Research Degree** in Major and Minor with 176 credits														
6.0/400	VII	10(T)+4(P)	2(T)+2 (T/P)	--	--	4(RM) (T)	--	--	--	--	--	--	--	22
	VIII	10(T)+4(P)	2(T)+2 (T/P)	--	4 (OJT)	--	--	--	--	--	--	--	--	22
Total 4Years		**72**	**16**	**8**	**14**	**22**	**8**	8	**6**	**4**	**8**	**4**	**6**	**176**
Four Year **UG Honours Degree** in Major and Minor with 176 credits														

T = Theory **P =** Practical **DSC =** Discipline Specific Course **OE =** Open Elective **SEC =** Skill Enhancement Course
IKS = Indian Knowledge System **AEC =** Ability Enhancement Course **VEC =** Value Education Course **CC =** Co-curricular Course
VSC= Vocational Skill Course **OJT=** On Job Training **CEP=** Community Engagement Project **FP=** Field Project **RP=** Research Project

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

Sem	Course Type	Course Code	Course Title	Course Types	Credits
I	DSC-I (General)	COSST-101-GEN	Descriptive Statistics	Theory	02
		COSST-102-GEN	Statistics Practical – I	Practical	02
	DSC-II (General)	COSMT-101-GEN	Discrete Mathematics	Theory	02
		COSMT-102-GEN	Discrete Mathematics practical using Maxima Software	Practical	02
	DSC-III(General)	COSEL-101-GEN	Basics of Electronics	Theory	02
		COSEL-102-GEN	Electronics Practical-I	Practical	02
	DSC-IV(General)	COS-101-GEN	Basic C Programming	Theory	02
		COS-102-GEN	Computer Science Practical – I	Practical	02
	Open Elective (OE)	COS-103-OE	Internet Awareness	Theory	02
	Skill Enhancement Course (SEC)	COS-104-SEC	Practical on DBMS Using PostgreSQL	Practical	02
	Ability Enhancement Course (AEC)	ENG-104-AEC	-----	Theory	02
	Value Education Course (VEC)	ENV-105-VEC	Environmental Science	Theory	02
	Generic Indian Knowledge System (GIKS)	GEN-106-IKS	------	Theory	02
	Total Credits				**22**
II	DSC-I (General)	COSST-151-GEN	Statistical Methods	Theory	02
		COSST-152-GEN	Statistics Practical – II	Practical	02
	DSC-II (General)	COSMT-151-GEN	Graph Theory	Theory	02
		COSMT-152-GEN	Graph Theory practical using C Programming	Practical	02
	DSC-III (General)	COSEL-151-GEN	Analog and Digital Circuits	Theory	02
		COSEL-152-GEN	Electronics Practical-II	Practical	02
	DSC-IV (General)	COS-151-GEN	Advanced C Programming	Theory	02
		COS-152-GEN	Computer Science Practical – II	Practical	02
	Open Elective (OE)	COS-153-OE	Introduction to MS-Office	Practical	02
	Skill Enhancement Course (SEC)	COS-154-SEC	Practical on RDBMS Using PostgreSQL	Practical	02
	Ability Enhancement Course (AEC)	ENG-154-AEC	----	Theory	02
	Value Education Course (VEC)	COS-155-VEC	Digital & Technological solutions	Theory	02
	CC	YOG/PES/CUL/NSS/NCC-156-CC	To be selected from the CC Basket	Theory	02
	Total Credits				**22**
	Grand Total Semester- I + Semester- II				**44**

Course Structure for S. Y. B.Sc. (Computer Science) (2024 Pattern)

Sem	Course Type	Course Code	Course Title	Course Types	Credits
III	Major Mandatory	COS-201-MRM	Basic Data Structure	Theory	02
	Major Mandatory	COS-202-MRM	Introduction to Web Design	Theory	02
	Major Mandatory	COS-203-MRM	Lab Course based on COS-201-MRM and COS-202-MRM	Practical	02
	Vocational Skill Course (VSC)	COS-204-VSC	Lab Course based on Object Oriented Programming using C++	Practical	02
	Field Project (FP)	COS-205-FP	Field Project	Practical	02
	Minor (Any one) (For B.Sc.(CS)) Statistics, Mathematics, Electronics	COS-206-MN(A)	Foundations of Probability	Theory	02
		COS-206-MN (B)	Groups and Coding Theory		
		COS-206-MN(C)	Communication Electronics		
	Minor (Any one) (For B.Sc.(CS)) Statistics, Mathematics, Electronics	COS-207-MN(A)	Minor Statistics Practical (CS)-I	Practical	02
		COS-207-MN (B)	Groups and Coding Theory Practical using SageMath Software		
		COS-207-MN(C)	Communication Practical Lab		
	Minor *(For Others)*	COS-206-MN(D)	HTML and CSS	Theory	02
	Minor *(For Others)*	COS-207-MN(D)	Lab Course based on COS-206-MN	Practical	02
	Open Elective (OE)	COS-208-OE	Fundamental Concepts in Computer Science	Theory	02
	Subject Specific Indian Knowledge System (IKS)	COS-209-IKS	Indian Knowledge Systems and Evolution in Computer Science	Theory	02
	Ability Enhancement Course (AEC)	MAR-210-AEC HIN-210-AEC SAN-210-AEC	--	Theory (Any One)	02
	Co-curricular Course (CC)	YOG/PES/CUL/NSS/ NCC-211-CC	To be continued from the Semester – II		02
	Total Credits Semester – III				**22**
IV	Major Mandatory	COS-251-MRM	Advanced Data Structure	Theory	02
	Major Mandatory	COS-252-MRM	Advanced Web Design	Theory	02
	Major Mandatory	COS-253-MRM	Lab Course based on COS-251-MRM and COS-252-MRM	Practical	02
	Vocational Skill Course (VSC)	COS-254-VSC	Core Java	Theory	02
	Community Engagement Project (CEP)	COS-255-CEP	Community Engagement Project	Practical	02
	Minor (Any one) (For B.Sc.(CS)) Statistics, Mathematics, Electronics	COS-256-MN(A)	Continuous Probability Distribution and Testing of hypothesis	Theory	02
		COS-256-MN (B)	Linear Algebra		
		COS-256-MN(C)	Fundamental of Instrumentation Techniques		
		COS-257-MN(A)	Minor Statistics Practical (CS)-II	Practical	02
		COS-257-MN (B)	Mathematics Practical using GeoGebra Software		
		COS-257-MN(C)	Instrumentation Practical Lab		
	Minor *(For Others)*	COS-256-MN(D)	JavaScript and Bootstrap	Theory	02
		COS-257-MN(D)	Lab Course based on COS-256-MN(D)	Practical	02
	Open Elective (OE)	COS-258-OE	Digital Marketing	Practical	02

	Skill Enhancement Course (SEC)	COS-259-SEC	Lab Course based on COS-254-VSC	Practical	02
	Ability Enhancement Course (AEC)	MAR-260-AEC HIN-260-AEC SAN-260-AEC	--	Theory (Any One)	02
	Co-curricular Course (CC)	YOG/PES/CUL/NSS/ NCC-261-CC	To be continued from the Semester – III		02
				Total Credits	**22**
	Grand Total Semester- III + Semester- IV				**44**

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

(2024 Pattern)

SEM- III Syllabus

Implementing from June - 2025

(A.Y. 2025-26)

Credit & Course Structure for S. Y. B. Sc. (Computer Science)(2024 Pattern)

Sem	Course Type	Course Code	Title of Course	Course Types	No. of Credits
III (5.0)	**Major Mandatory**	COS-201-MJM	Basic Data Structures	Theory	02
	Major Mandatory	COS-202-MJM	Introduction to Web Design	Theory	02
	Major Mandatory	COS-203-MJM	Lab Course based on COS-201-MJM and COS-202-MJM	Practical	02
	Vocational Skill Course (VSC)	COS-204-VSC	Lab Course based on Object Oriented Programming using C++	Practical	02
	Field Project (FP)	COS-205-FP	Field Project	Practical	02
	Minor (For B.Sc.(CS)) Statistics, Mathematics, Electronics	COS-206-MN(A)/	Foundations of Probability	Theory **(Any one)**	02
		COS-206-MN(B)/	Groups & Coding Theory		
		COS-206-MN(C)	Communication Electronics		
	Minor (For B.Sc.(CS)) Statistics, Mathematics, Electronics	COS-207-MN(A)/	Minor Statistics Practical (CS)-I	Practical **(Any one)**	02
		COS-207-MN(B)/	Groups and Coding Theory Practical using SageMath Software		
		COS-207-MN(C)	Communication Practical Lab		
	Minor *(For Others)*	COS-206-MN(D)	HTML and CSS	Theory	02
	Minor *(For Others)*	COS-207-MN(D)	Lab Course based on COS-206-MN (D)	Practical	02
	Open Elective (OE)	COS-208-OE	Areas in Computer Science	Theory	02
	Subject Specific Indian Knowledge System (IKS)	COS-209-IKS	Indian Knowledge System and Evolution in Computer Science	Theory	02
	Ability Enhancement Course (AEC)	MAR-210-AEC , HIN-210-AEC, SAN-210-AEC	मराठी भाषेची कौशल्ये - १ हिंदी भाषा : सृजन कौशल	Theory **(Any one)**	02
	Co-curricular Course (CC)	YOG/PES/CUL/ NSS/NCC-211-CC	To be Continued from the Semester – II		02
				Total Credits Semester - III	**22**

SYLLABUS (CBCS as per NEP 2020) FOR S. Y. B. Sc. (Computer Science)
(w. e. from June, 2025)

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

Prerequisites:

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

Objective:

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

Course Outcome :

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

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

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

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

CO5. Analyse and study various proof techniques.

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

CO7. To efficiently implement the different data structures.

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

References:

1. Fundamentals of Data Structures ---- By Horowitz Sahani (Galgotia)

2. Data Structures using C and C++ --- By Yedidyah Langsam, Aaron M. Tenenbaum, Moshe J. Augenstein

3. Introduction to Data Structures using C---By Ashok Kamthane

4. Data Structures using C --- Bandopadhyay & Dey (Pearson)

5. Data Structures using C ---By Srivastav

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

Mapping of CO WITH PO

CO1 With PO1 : As proficiency in using data structures demonstrates a profound understanding of foundational theories and principles within the field of study, essential for problem-solving in a multidisciplinary context.

CO2 With PO1 : As the ability to differentiate between different data structures and their appropriate usage showcases a deep understanding of methodologies and key concepts, contributing to a broader multidisciplinary perspective.

CO3 With PO1 : As understanding discrete structures is foundational to grasping the theoretical underpinnings of computer science, enhancing knowledge within a broader multidisciplinary context.

CO4 With PO1 : As studying propositional logic and Boolean algebra provides a theoretical framework that is crucial for understanding foundational theories and principles within the field of study, contributing to a broader multidisciplinary perspective.

CO5 With PO1 : As the ability to analyze proof techniques demonstrates proficiency in applying methodologies and key concepts within the field of study, essential for understanding foundational theories and principles in a broader multidisciplinary context.

CO6 With PO1 : As understanding memory allocation contributes to a practical understanding of computer science concepts, although it may be less directly related to multidisciplinary contexts covered in PO1.

CO7 With PO1 : As the ability to efficiently implement data structures demonstrates practical application of foundational theories and principles, essential for problem-solving within a broader multidisciplinary context.

CO1 With PO2 : As practical skills in utilizing data structures are essential for professional tasks in problem-solving within real-world scenarios, aligning with industry standards and best practices.

CO2 With PO2 : As the ability to differentiate between different data structures and select the appropriate one for problem-solving reflects expertise and practical skills needed in professional tasks, adhering to industry standards and best practices.

CO3 With PO2 : As understanding discrete structures is fundamental for applying knowledge in real-world scenarios, ensuring adherence to industry standards and best practices in problem-solving tasks.

CO4 With PO2 : As studying propositional logic and Boolean algebra provides a theoretical foundation essential for understanding industry standards, regulations, and ethical considerations in real-world scenarios.

CO5 With PO2 : As the ability to analyze proof techniques enhances problem-solving skills in professional tasks, aligning with industry standards and best practices.

CO6 With PO2: As understanding memory allocation is practical knowledge applicable to professional tasks, although it may be less directly related to industry standards and regulations.

CO7 With PO2 : As the ability to efficiently implement data structures demonstrates practical expertise essential for professional tasks, aligning with industry standards and best practices.

CO1 With PO3: As the ability to use data structures can contribute to problem-solving skills, which are important in identifying opportunities and fostering innovation, although it may not directly address business principles, market dynamics, and risk management strategies.

CO2 With PO3 : As the ability to differentiate between different data structures can enhance problem-solving abilities, which can indirectly contribute to fostering innovation and understanding market dynamics.

CO3 With PO3: As understanding discrete structures may have limited direct relevance to cultivating an entrepreneurial mindset and understanding business principles, market dynamics, and risk management strategies.

CO4 With PO3 : As studying propositional logic and Boolean algebra may have limited direct relevance to entrepreneurial mindset or business principles, although it may indirectly enhance analytical skills important for risk management.

CO5 With PO3 : As studying proof techniques may have limited direct relevance to entrepreneurship or business principles, although it may indirectly enhance critical thinking skills important for identifying opportunities and fostering innovation.

CO6 With PO3 : As understanding memory allocation may have limited direct relevance to entrepreneurial mind set or business principles, although it may indirectly contribute to problem-solving abilities.

CO7 With PO3 : As the ability to efficiently implement data structures can contribute to problem-solving skills, which are important in identifying opportunities and fostering innovation, although it may not directly address business principles, market dynamics, and risk management strategies.

CO1 With PO4 : As proficiency in utilizing data structures demonstrates technical skills, analytical abilities, and problem-solving capabilities, essential for adapting and innovating in response to changing circumstances.

CO2 With PO4 : As the ability to differentiate between different data structures showcases analytical abilities and problem-solving skills, crucial for adapting and innovating in response to changing circumstances.

CO3 With PO4 : As understanding discrete structures enhances analytical abilities and problem-solving skills, although its direct impact on technical proficiency and effective communication may be limited.

CO4 With PO4 : As studying propositional logic and Boolean algebra develops analytical abilities and problem-solving skills, although its direct impact on technical proficiency and effective communication may be limited.

CO5 With PO4 : As analyzing proof techniques enhances analytical abilities and problem-solving skills, although its direct impact on technical proficiency and effective communication may be limited.

CO6 With PO4 : As understanding memory allocation contributes to technical proficiency and problem-solving skills, although its direct impact on effective communication and leadership may be limited.

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

CO1 With PO5 : As the ability to use data structures effectively in problem-solving requires critical thinking, creativity, adaptability, and readiness to learn, essential for applying learned concepts in practical settings and solving complex problems.

CO2 With PO5 : As the ability to differentiate between different data structures demonstrates critical thinking and adaptability, crucial for analyzing data effectively and solving complex problems in practical settings.

CO3 With PO5 : As understanding discrete structures enhances critical thinking and problem-solving abilities, essential for analyzing data effectively and solving complex problems in practical settings.

CO4 With PO5 : As studying propositional logic and Boolean algebra develops analytical skills and critical thinking, although its direct impact on creativity, adaptability, and readiness to take calculated risks may be limited.

CO5 With PO5 : As analyzing proof techniques requires critical thinking and creativity, essential for solving complex problems and taking calculated risks in practical settings.

CO6 With PO5 : As understanding memory allocation contributes to problem-solving abilities, although its direct impact on critical thinking and adaptability may be limited.

CO7 With PO5 : As efficiently implementing data structures requires critical thinking, creativity, adaptability, and a readiness to learn, essential for applying learned concepts in practical settings and solving complex problems.

CO1 With PO6 : As effectively communicating complex information and collaborating in diverse teams may require the ability to articulate the usage of data structures in problem-solving, but it may not directly address communication skills or teamwork.

CO2 With PO6 : As the ability to differentiate between different data structures may indirectly contribute to effective communication and collaboration by facilitating clear explanations and discussions within teams.

CO3 With PO6: As understanding discrete structures may not directly address communication skills or teamwork but may indirectly contribute to problem-solving abilities within teams.

CO4 With PO6 : As studying propositional logic and Boolean algebra may enhance analytical skills but may not directly contribute to effective communication or teamwork.

CO5 With PO6: as studying proof techniques may improve critical thinking skills but may not directly address communication skills or teamwork.

CO6 With PO6 : as understanding memory allocation may not directly contribute to communication skills or teamwork but may indirectly support problem-solving abilities within teams.

CO7 With PO6 : as efficiently implementing data structures may indirectly support effective communication and collaboration by ensuring that team members understand and utilize appropriate structures in problem-solving tasks.

CO1 With PO7: as the ability to use data structures effectively may indirectly support observational and inquiry skills by providing a structured approach to problem-solving, although it may not directly address research methodologies or ethics.

CO2 With PO7 : as the ability to differentiate between different data structures may indirectly contribute to observational and inquiry skills by fostering critical thinking and analytical abilities, although it may not directly address research methodologies or ethics.

CO3 With PO7: as understanding discrete structures may enhance analytical skills but may not directly contribute to observational and inquiry skills, research methodologies, or ethics.

CO4 With PO7 : as studying propositional logic and Boolean algebra may improve analytical skills but may not directly address observational and inquiry skills, research methodologies, or ethics.

CO5 With PO7: as studying proof techniques may enhance critical thinking skills but may not directly contribute to observational and inquiry skills, research methodologies, or ethics.

CO6 With PO7: as understanding memory allocation may support problem-solving abilities but may not directly address observational and inquiry skills, research methodologies, or ethics.

CO7 With PO7: as efficiently implementing data structures may indirectly support observational and inquiry skills by providing practical experience with structured problem-solving, although it may not directly address research methodologies or ethics.

CO1 With PO8: as the ability to utilize data structures effectively demonstrates self-directed learning by acquiring new knowledge and skills, adapting to changing demands, and setting and achieving goals independently through problem-solving.

CO2 With PO8: as the ability to differentiate between different data structures reflects self-directed learning by acquiring a deeper understanding of their functionalities, adapting to changing demands, and setting and achieving goals independently in problem-solving tasks.

CO3 With PO8: as understanding discrete structures enhances problem-solving abilities and reflects self-directed learning, although its direct impact on adaptability to changing demands and goal achievement may be limited.

CO4 With PO8 : as studying propositional logic and Boolean algebra enhances analytical skills and reflects self-directed learning, although its direct impact on adaptability and goal achievement may be limited.

CO5 With PO8: as analyzing proof techniques develops critical thinking skills and reflects self-directed learning, although its direct impact on adaptability and goal achievement may be limited.

CO6 With PO8: as understanding memory allocation contributes to problem-solving abilities and reflects self-directed learning, although its direct impact on adaptability and goal achievement may be limited.

CO7 With PO8: as efficiently implementing data structures demonstrates self-directed learning by acquiring practical skills, adapting to changing demands, and setting and achieving goals independently in problem-solving tasks.

CO1 With PO9: as proficiency in using data structures is essential for effectively organizing and analyzing data using appropriate software, aligning with the demonstration of proficiency in ICT and data analysis.

CO2 With PO9 : as the ability to differentiate between different data structures reflects proficiency in understanding and utilizing appropriate software for data analysis, accessing information sources, and utilizing ICT effectively.

CO3 With PO9: as understanding discrete structures contributes to analytical skills, although its direct impact on using ICT and accessing information sources may be limited.

CO4 With PO9: as studying logic and algebra enhances analytical abilities, although its direct impact on using ICT and accessing information sources may be limited.

CO5 With PO9: as analyzing proof techniques enhances critical thinking skills, although its direct impact on using ICT and accessing information sources may be limited.

CO6 With PO9: as understanding memory allocation contributes to technical skills but may have limited direct relevance to using ICT and accessing information sources. **CO7 With PO9:** as efficiently implementing data structures demonstrates proficiency in utilizing appropriate software for data analysis, accessing information sources, and using ICT effectively.

CO1 With PO10: as the ability to utilize data structures effectively may indirectly contribute to engaging effectively in multicultural settings by fostering problem-solving skills and analytical thinking, although its direct impact on leading diverse teams and demonstrating empathy may be limited.

CO2 With PO10 : as the ability to differentiate between different data structures may indirectly support engaging effectively in multicultural settings by promoting critical thinking and adaptability, although its direct impact on leading diverse teams and demonstrating empathy may be limited.

CO3 With PO10 : as understanding discrete structures may enhance analytical skills but may not directly address engagement in multicultural settings or leading diverse teams.

CO4 With PO10 : as studying logic and algebra may improve analytical skills but may not directly contribute to engaging in multicultural settings or leading diverse teams.

CO5 With PO10 : as analyzing proof techniques may enhance critical thinking skills but may not directly address engagement in multicultural settings or leading diverse teams.

CO6 With PO10: as understanding memory allocation contributes to technical skills but may not directly impact engagement in multicultural settings or leading diverse teams.

CO7 With PO10: as efficiently implementing data structures may indirectly support engagement in multicultural settings by fostering problem-solving skills and adaptability, although its direct impact on leading diverse teams and demonstrating empathy may be limited.

CO1 With PO11: as the ability to use data structures effectively may indirectly contribute to addressing ethical issues by promoting structured problem-solving and decision-making, although its direct impact on embracing ethical values and promoting sustainability may be limited.

CO2 With PO11: as the ability to differentiate between different data structures may indirectly support recognizing and addressing ethical issues by enhancing analytical skills and critical thinking, although its direct impact on ethical values and environmental conservation may be limited.

CO3 With PO11: as understanding discrete structures may enhance problem-solving abilities but may not directly address ethical values or environmental conservation.

CO4 With PO11: as studying logic and algebra may improve analytical skills but may not directly contribute to embracing ethical values or promoting sustainability.

CO5 With PO11: as analyzing proof techniques may enhance critical thinking skills but may not directly address ethical values or environmental conservation.

CO6 With PO11: as understanding memory allocation contributes to technical skills but may not directly impact ethical values or environmental conservation.

CO7 With PO11: as efficiently implementing data structures may indirectly support responsible citizenship by promoting effective use of resources and decision-making, although its direct impact on ethical values and environmental conservation may be limited.

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

CO2 With PO12: as the ability to differentiate between different data structures reflects analytical skills and contributes to effective project management and responsibility in work contexts.

CO3 With PO12: as understanding discrete structures enhances problem-solving abilities, which are crucial for managing projects effectively and demonstrating accountability in work contexts.

CO4 With PO12: as studying logic and algebra enhances analytical skills, which are important for independent application of knowledge and skills and effective project management.

CO5 With PO12: as analyzing proof techniques fosters critical thinking and problem-solving abilities, which are relevant for managing projects effectively and demonstrating responsibility in work contexts.

CO6 With PO12: as understanding memory allocation contributes to technical skills necessary for independent application of knowledge and skills and effective project management.

CO7 With PO12: as efficiently implementing data structures demonstrates proficiency in applying knowledge and skills independently, managing projects effectively, and showing responsibility and accountability in work and learning contexts.

CO1 With PO13: as the ability to use data structures effectively can indirectly support community-engaged services by facilitating problem-solving skills, although its direct impact on promoting societal well-being may be limited.

CO2 With PO13: as the ability to differentiate between different data structures reflects analytical skills, which can indirectly contribute to community-engaged services by fostering critical thinking, although its direct impact on promoting societal well-being may be limited.

CO3 With PO13: as understanding discrete structures may enhance problem-solving abilities but may not directly contribute to community-engaged services or promoting societal well-being.

CO4 With PO13: as studying logic and algebra enhances analytical skills but may not directly impact community-engaged services or societal well-being.

CO5 With PO13: as analyzing proof techniques fosters critical thinking skills but may not directly contribute to community-engaged services or promoting societal well-being.

CO6 With PO13 : as understanding memory allocation contributes to technical skills but may not directly impact community-engaged services or societal well-being.

CO7 With PO13: as efficiently implementing data structures demonstrates proficiency in problem-solving, which can indirectly support community-engaged services by facilitating effective solutions, although its direct impact on promoting societal well-being may be limited.

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SYLLABUS (CBCS as per NEP 2020 (2024 Pattern) FOR
S. Y. B. Sc. (Computer Science)(w. e. from June, 2025)

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

Prerequisites:

- Basic knowledge of computers and its concepts.

Course Objectives:

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

Course Outcomes:

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

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

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

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

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

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

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

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

References:

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

Mapping of this course with Programme Outcomes

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

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

Justification of Mapping of PO1 with All CO'S

CO1: PO1: Constructing HTML documents with proper structures and utilizing HTML tags effectively directly demonstrates a profound understanding of foundational theories, principles, and methodologies in web development, aligning strongly with the comprehensive knowledge and understanding of the field of study.

CO2: PO1: Implementing specific HTML5 elements and various layout components requires a deep understanding of foundational concepts and key principles in web development, contributing significantly to the comprehensive knowledge and understanding of the field.

CO3: PO1: Applying the basics of CSS and understanding its role in styling HTML elements enhances the comprehension of foundational theories and methodologies in web design, closely linked with the broader multidisciplinary context of the field of study.

CO4: PO1: Applying CSS rules effectively to control the appearance of HTML elements demonstrates a profound understanding of CSS principles and methodologies, reinforcing the comprehensive knowledge and understanding of the field.

CO5: PO1: Designing web pages using HTML5 and CSS showcases a deep understanding of foundational theories, methodologies, and key concepts in web development, contributing significantly to the broader multidisciplinary context of the field of study.

CO6: PO1: Designing dynamic, interactive, and elegant websites requires a profound understanding of advanced concepts and principles in web development, aligning strongly with the comprehensive knowledge and understanding of the field.

CO7: PO1: Analyzing and exploring web pages to identify their elements and attributes demonstrates a deep understanding of foundational theories and methodologies in web development, reinforcing the comprehensive knowledge and understanding of the field.

Mapping of PO2 with All CO'S

CO1: PO2: Constructing HTML documents with proper structures and utilizing HTML tags effectively aligns closely with practical skills and expertise essential for professional tasks in web development, demonstrating knowledge of industry standards and best practices.

CO2: PO2: Implementing specific HTML5 elements demonstrates practical skills essential for professional tasks in web development, incorporating knowledge of industry standards and best practices to create functional and effective web pages.

CO3: PO2: Applying the basics of CSS to enhance web page aesthetics reflects practical knowledge and expertise in web design, considering industry standards and best practices to create visually appealing websites.

CO4: PO2: Applying CSS rules effectively to control the appearance of HTML elements showcases practical skills in web development, incorporating industry standards and best practices to achieve desired styling outcomes.

CO5: PO2: Designing web pages using HTML5 and CSS demonstrates practical expertise in web development, applying industry standards and best practices to create professional and functional websites.

CO6: PO2: Designing dynamic, interactive, and elegant websites requires practical skills and expertise in web development, incorporating industry standards and best practices to create engaging user experiences.

CO7: PO2: Analyzing and exploring web pages to identify their elements and attributes showcases practical knowledge essential for professional tasks in web development, incorporating industry standards and best practices to understand and manipulate web content effectively.

Mapping of PO3 with All CO'S

CO1: PO3: Constructing HTML documents demonstrates technical proficiency, which is partially related to fostering innovation and understanding business principles but is not directly linked to entrepreneurial mindset or risk management strategies.

CO2: PO3: Implementing specific HTML5 elements showcases technical skills but is only partially related to identifying opportunities and fostering innovation in entrepreneurial contexts.

CO3: PO3: Applying CSS basics to enhance web page aesthetics is partially related to understanding business principles and market dynamics, but it doesn't directly contribute to cultivating an entrepreneurial mindset.

CO4: PO3: Applying CSS rules to control the appearance of HTML elements is partially related to understanding business principles and market dynamics but doesn't directly contribute to fostering innovation or risk management strategies.

CO5: PO3: Designing web pages using HTML5 and CSS demonstrates technical skills but is only partially related to cultivating an entrepreneurial mindset.

CO6: PO3: Designing dynamic, interactive, and elegant websites may indirectly contribute to fostering innovation and understanding market dynamics but is only partially related to cultivating an entrepreneurial mindset.

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

Mapping of PO4 with All CO'S

CO1: PO4: Constructing HTML documents and utilizing HTML tags effectively demonstrates technical proficiency and problem-solving skills, directly related to specialized skills and competencies in web development.

CO2: PO4: Implementing specific HTML5 elements requires technical skills and problem-solving abilities, closely related to specialized competencies in web development.

CO3: PO4: Applying CSS basics to enhance web page aesthetics demonstrates technical proficiency and analytical abilities, directly relevant to specialized skills and competencies in web design.

CO4: PO4: Applying CSS rules effectively to control the appearance of HTML elements showcases technical skills and problem-solving abilities, directly related to specialized competencies in web development.

CO5: PO4: Designing web pages using HTML5 and CSS requires technical proficiency, problem-solving skills, and effective communication, all of which are specialized competencies in web development.

CO6: PO4: Designing dynamic, interactive, and elegant websites showcases technical skills, analytical abilities, and innovation, directly relevant to specialized competencies in web development.

CO7: PO4: Analyzing and exploring web pages demonstrates analytical abilities, problem-solving skills, and adaptability, all of which are specialized competencies in web development.

Mapping of PO5 with All CO'S

CO1: PO5: Constructing HTML documents and utilizing HTML tags effectively requires problem-solving and analytical reasoning, directly linked to the capacity for application and problem-solving.

CO2: PO5: Implementing specific HTML5 elements involves problem-solving and analytical reasoning to select appropriate elements and layouts, directly contributing to the capacity for application and problem-solving.

CO3: PO5: Applying CSS basics to enhance web page aesthetics requires analytical reasoning and adaptability, directly relevant to problem-solving and analytical reasoning in practical web development scenarios.

CO4: PO5: Applying CSS rules effectively to control the appearance of HTML elements involves problem-solving and analytical reasoning to achieve desired outcomes, directly related to the capacity for application and problem-solving.

CO5: PO5: Designing web pages using HTML5 and CSS necessitates problem-solving, analytical reasoning, and creativity, directly contributing to the capacity for application and problem-solving in web development.

CO6: PO5: Designing dynamic, interactive, and elegant websites requires problem-solving, creativity, and adaptability, directly linked to the capacity for application, problem-solving, and analytical reasoning.

CO7: PO5: Analyzing and exploring a web page demonstrates problem-solving, analytical reasoning, and adaptability, directly relevant to the capacity for application, problem-solving, and analytical reasoning in web development contexts.

Mapping of PO6 with All CO'S

CO1: PO6: Constructing HTML documents and utilizing HTML tags effectively may involve communication when collaborating with team members to ensure consistency and clarity in code, moderately related to effective communication in diverse teams.

CO2: PO6: Implementing specific HTML5 elements requires collaboration and communication within teams to discuss layout components and functionalities, moderately related to effective communication and collaboration.

CO3: PO6: Applying CSS basics to enhance web page aesthetics may involve communicating design preferences or requirements, moderately related to effective communication in conveying visual concepts.

CO4: PO6: Applying CSS rules effectively may involve communication with team members to ensure consistency in styling across web pages, moderately related to effective communication and collaboration.

CO5: PO6: Designing web pages using HTML5 and CSS may involve collaboration and communication to discuss design choices and functionalities, moderately related to effective communication and collaboration.

CO6: PO6: Designing dynamic, interactive, and elegant websites often requires collaboration and communication to align on design goals and functionalities, strongly related to effective communication and collaboration.

CO7: PO6: Analyzing and exploring a web page may involve communication within teams to discuss findings and implications for design changes, moderately related to effective communication and collaboration.

Mapping of PO7 with All CO'S

CO1: PO7: Constructing HTML documents and utilizing HTML tags effectively may involve some observational skills when analyzing existing web pages for inspiration or research purposes, partially related to research-related skills.

CO2: PO7: Implementing specific HTML5 elements requires some observational skills when analyzing different websites for functionality and layout ideas, partially related to research-related skills.

CO3: PO7: Applying CSS basics to enhance web page aesthetics involves observational skills when evaluating design choices, partially related to research-related skills.

CO4: PO7: Applying CSS rules effectively may involve some observational skills when examining the impact of styling changes on web page appearance, partially related to research-related skills.

CO5: PO7: Designing web pages using HTML5 and CSS may involve observational skills when researching design trends or analyzing competitor websites, partially related to research-related skills.

CO6: PO7: Designing dynamic, interactive, and elegant websites involves observational skills when researching user preferences and behaviors, partially related to research-related skills.

CO7: PO7: Analyzing and exploring a web page demonstrates strong observational and inquiry skills, directly related to research-related skills in data collection and analysis.

Mapping of PO8 with All CO'S

CO1: PO8: Constructing HTML documents and utilizing HTML tags effectively requires self-directed learning and goal setting to acquire and apply new knowledge independently.

CO2: PO8: Implementing specific HTML5 elements involves self-directed learning and adaptability to learn new techniques and functionalities independently.

CO3: PO8: Applying the basics of CSS and understanding its role in styling HTML elements necessitates self-directed learning and goal setting to master CSS techniques independently.

CO4: PO8: Applying CSS rules effectively requires self-directed learning and adaptability to keep up with evolving CSS standards and techniques independently.

CO5: PO8: Designing web pages using HTML5 and CSS involves self-directed learning and goal setting to integrate HTML and CSS effectively to achieve design goals independently.

CO6: PO8: Designing dynamic, interactive, and elegant websites requires continuous self-directed learning and adaptability to incorporate new technologies and design trends independently.

CO7: PO8: Analyzing and exploring a web page demonstrates self-directed learning and adaptability to acquire and apply analytical skills independently.

Mapping of PO9 with All CO'S

CO1: PO9: Constructing HTML documents and utilizing HTML tags effectively demonstrate proficiency in using ICT and accessing information sources to create web content.

CO2: PO9: Implementing specific HTML5 elements involves proficiency in using ICT and accessing information sources to select and integrate appropriate elements into web pages.

CO3: PO9: Applying the basics of CSS to enhance web page aesthetics requires proficiency in using ICT and accessing information sources to learn and apply styling techniques.

CO4: PO9: Applying CSS rules effectively involves proficiency in using ICT to manipulate and control the appearance of HTML elements.

CO5: PO9: Designing web pages using HTML5 and CSS demonstrates proficiency in using ICT to create functional and aesthetically pleasing websites.

CO6: PO9: Designing dynamic, interactive, and elegant websites showcases proficiency in using ICT to integrate advanced features and technologies into web design.

CO7: PO9: Analyzing and exploring a web page demonstrates proficiency in using ICT to navigate and understand web content and identify its elements and attributes.

Mapping of PO10 with All CO'S

CO1: PO10: Constructing HTML documents and utilizing HTML tags effectively doesn't directly involve engagement in multicultural settings or demonstrating empathy and understanding of diverse perspectives.

CO2: PO10: Implementing specific HTML5 elements may involve collaboration with diverse teams, but it doesn't inherently demonstrate multicultural competence or empathy.

CO3: PO10: Applying CSS to enhance web page aesthetics doesn't directly relate to engagement in multicultural settings or demonstrating empathy.

CO4: PO10: Applying CSS rules effectively also doesn't directly involve engagement in multicultural settings or demonstrating empathy.

CO5: PO10: Designing web pages using HTML5 and CSS may involve considering diverse user perspectives, but it doesn't inherently demonstrate engagement in multicultural settings or empathy.

CO6: PO10: Designing dynamic, interactive, and elegant websites may involve collaboration with diverse teams, but it doesn't directly demonstrate multicultural competence or empathy.

CO7: PO10: Analyzing and exploring a web page may involve considering diverse user perspectives, but it doesn't inherently demonstrate engagement in multicultural settings or empathy.

Mapping of PO11 with All CO'S

CO1: PO11: Constructing HTML documents and utilizing HTML tags effectively doesn't inherently involve embracing ethical and moral values, practicing responsible citizenship, or addressing environmental issues.

CO2: PO11: Implementing specific HTML5 elements may involve considering accessibility standards, but it doesn't directly relate to promoting sustainability or environmental conservation.

CO3: PO11: Applying CSS to enhance web page aesthetics doesn't directly relate to embracing ethical values or promoting environmental awareness.

CO4: PO11: Applying CSS rules effectively also doesn't directly involve embracing ethical values or promoting environmental awareness.

CO5: PO11: Designing web pages using HTML5 and CSS may involve considering the environmental impact of design choices, but it doesn't inherently promote sustainability or environmental conservation.

CO6: PO11: Designing dynamic, interactive, and elegant websites may involve considering user experience, but it doesn't directly relate to embracing ethical values or promoting environmental awareness.

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

Mapping of PO12 with All CO'S

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

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

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

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

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

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

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

Mapping of PO13 with All CO'S

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

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

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

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

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

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

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

SYLLABUS (CBCS as per NEP 2020) FOR S. Y. B. Sc. (Computer Science)
(w. e. from June, 2025)

Name of the Programme : B.Sc. Computer Science
Program Code : USCOS
Class **:** S.Y.B.Sc. (Computer Science)
Semester **: III**
Course Type **:** Major
Course Name **:** Lab Course I – Based on COS-201-MJM, COS-202-MJM
Course Code **:** COS-203-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** : Applications of Array - Sorting **SET B**: Be acquainted with elements, Tags and advanced text formatting.
Assignment 2	**SET A** : Applications of Array - Searching **SET B**: Practical implementation of all kinds of List in HTML5.
Assignment 3	**SET A** : Operations on Linked List **SET B** : Practical implementation of all kinds of Tables in HTML5.
Assignment 4	**SET A** : Operations on Linked List **SET B** : Designing of webpage with the help of iframes.
Assignment 5	**SET A** : Static implementation of Stack **SET B** : Practical implementation of Forms.
Assignment 6	**SET A** : Dynamic implementation of Stack **SET B** : Designing and Implementation of CSS for Webpages, Lists and Tables.

References:

1. **"Introduction to Algorithms"** – Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein (*Also known as CLRS*)
2. **"Data Structures and Algorithms Made Easy"** – Narasimha Karumanchi
3. Html & CSS: The Complete Reference, Fifth Edition by Thomas A. Powell and published by McGraw Hill.
4. HTML 5 in simple steps by Kogent Learning Solutions Inc., Publisher Dreamtech Press
5. Headfirst HTML with CSS & XHTML Book by Elisabeth Freeman and Eric Freeman.
6. The Essential Guide to CSS and HTML Web Design Book by Craig Grannell.

Mapping of this course with Programme Outcomes

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

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

Justification of Mapping of PO1 with All CO'S

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

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

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

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

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

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

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

Mapping of PO2 with All CO'S

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

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

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

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

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

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

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

Mapping of PO3 with All CO'S

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

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

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

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

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

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

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

Mapping of PO4 with All CO'S

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

CO2: PO4: Understanding memory allocation and its application involves technical proficiency and problem-solving skills, crucial for specialized skills and competencies.

CO3: PO4: Analyzing proof techniques enhances analytical abilities and problem-solving skills, directly relevant to specialized skills and competencies.

CO4: PO4: Practical implementation of HTML5 and CSS technologies contributes to technical skills and problem-solving, though may not directly address all aspects of effective communication and leadership.

CO5: PO4: Applying HTML5 technologies to design websites requires technical proficiency and problem-solving skills, contributing to specialized skills and competencies, though communication and leadership aspects may be less emphasized.

CO6: PO4: Analyzing web page elements and attributes enhances technical skills and analytical abilities, directly relevant to specialized skills and competencies.

CO7: PO4: Creating web pages using CSS requires technical skills and problem-solving, contributing to specialized skills and competencies, though communication and leadership aspects may be less emphasized.

Mapping of PO5 with All CO'S

CO1: PO5: Efficient implementation of data structures requires problem-solving skills, analytical reasoning, and adaptability, closely aligning with the capacity for application, problem-solving, and analytical reasoning.

CO2: PO5: Understanding memory allocation involves problem-solving and analytical reasoning, essential for applying concepts in practical settings and solving complex problems.

CO3: PO5: Analyzing proof techniques enhances analytical reasoning and critical thinking, directly relevant to problem-solving and analytical reasoning.

CO4: PO5: Practical implementation of HTML5 and CSS technologies requires creativity and adaptability, contributing to problem-solving and analytical reasoning, though not as directly related as other objectives.

CO5: PO5: Applying HTML5 technologies to design dynamic websites involves critical thinking, creativity, and adaptability, closely aligning with problem-solving and analytical reasoning.

CO6: PO5: Analyzing web page elements and attributes requires critical thinking and analytical reasoning, directly relevant to problem-solving and analytical reasoning.

CO7: PO5: Creating web pages using CSS requires problem-solving skills and adaptability, contributing to the capacity for application, problem-solving, and analytical reasoning, though not as directly related as other objectives.

Mapping of PO6 with All CO'S

CO1: PO6: Efficient implementation of data structures may not directly contribute to communication skills and collaboration unless effectively communicated and collaborated upon within a team.

CO2: PO6: Understanding memory allocation basics may not directly enhance communication skills and collaboration.

CO3: PO6: Analyzing proof techniques may not directly improve communication skills and collaboration.

CO4: PO6: Practical implementation of HTML5 and CSS technologies may require communication and collaboration within a team, although it's not the primary focus.

CO5: PO6: Applying HTML5 technologies to design websites involves effective communication of ideas and collaboration with clients or team members, directly relevant to communication skills and collaboration.

CO6: PO6: Analyzing web page elements and attributes may involve communicating findings to team members and collaborating on web design projects.

CO7: PO6: Creating web pages using CSS may involve collaboration with designers and developers, contributing to communication skills and collaboration within a team.

Mapping of PO7 with All CO'S

CO1: PO7: While implementing data structures may involve problem-solving and analysis, it's not directly related to observational skills, inquiry, or research methodologies.

CO2: PO7: Understanding memory allocation basics is crucial for programming but doesn't directly contribute to research-related skills such as observational skills, inquiry, or research methodologies.

CO3: PO7: Analyzing proof techniques is important for problem-solving but may not directly contribute to research-related skills.

CO4: PO7: Practical implementation of HTML5 and CSS technologies may not directly involve research-related skills unless applied within a research context.

CO5: PO7: Applying HTML5 technologies to design websites may involve inquiry, data collection, and analysis, contributing to research-related skills, albeit indirectly.

CO6: PO7: Analyzing web page elements and attributes may involve observational skills and inquiry, contributing partially to research-related skills.

CO7: PO7: Creating web pages using CSS may involve inquiry, adherence to methodologies, and effective reporting, contributing partially to research-related skills.

Mapping of PO8 with All CO'S

CO1: PO8: Efficiently implementing data structures requires self-directed learning, adaptability, and goal achievement, closely aligned with learning how to learn skills.

CO2: PO8: Understanding memory allocation involves self-directed learning and adaptability, directly relevant to learning how to learn skills.

CO3: PO8: Analyzing proof techniques enhances problem-solving abilities, contributing to learning how to learn skills, though indirectly.

CO4: PO8: Practical implementation of HTML5 and CSS technologies may require self-directed learning and adaptability to keep up with changing demands in web development.

CO5: PO8: Applying HTML5 technologies to design websites involves continuous learning, adaptation, and goal achievement, directly related to learning how to learn skills.

CO6: PO8: Analyzing web page elements and attributes requires self-directed learning and adaptability, contributing to learning how to learn skills.

CO7: PO8: Creating web pages using CSS requires continuous learning and adaptation to new design trends, supporting learning how to learn skills.

Mapping of PO9 with All CO'S

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

CO2: PO9: Understanding memory allocation involves utilizing appropriate software and ICT tools, contributing partially to digital and technological skills.

CO3: PO9: Analyzing proof techniques may not directly involve ICT or specific software usage.

CO4: PO9: Practical implementation of HTML5 and CSS technologies directly involves proficiency in using ICT and appropriate software, strongly related to digital and technological skills.

CO5: PO9: Applying HTML5 technologies to design websites involves proficiency in using ICT and appropriate software for web development, strongly related to digital and technological skills.

CO6: PO9: Analyzing web page elements and attributes may involve using ICT tools for web analysis, contributing moderately to digital and technological skills.

CO7: PO9: Creating web pages using CSS directly involves proficiency in using ICT and appropriate software, strongly related to digital and technological skills.

Mapping of PO10 with All CO'S

CO1: PO10: Efficient implementation of data structures does not directly involve engaging in multicultural settings, demonstrating empathy, or understanding diverse perspectives.

CO2: PO10: Understanding memory allocation basics is not directly related to engaging in multicultural settings or demonstrating empathy.

CO3: PO10: Analyzing proof techniques does not directly involve engaging in multicultural settings or demonstrating empathy.

CO4: PO10: Practical implementation of HTML5 and CSS technologies does not inherently involve engaging in multicultural settings or demonstrating empathy.

CO5: PO10: Applying HTML5 technologies to design websites does not directly involve engaging in multicultural settings or demonstrating empathy.

CO6: PO10: Analyzing web page elements and attributes does not directly involve engaging in multicultural settings or demonstrating empathy.

CO7: PO10: Creating web pages using CSS does not directly involve engaging in multicultural settings or demonstrating empathy.

Mapping of PO11 with All CO'S

CO1: PO11: Efficiently implementing data structures does not directly involve embracing ethical and moral values, practicing responsible citizenship, or promoting sustainability and environmental conservation.

CO2: PO11: Understanding memory allocation basics is not directly related to embracing ethical and moral values or promoting sustainability.

CO3: PO11: Analyzing proof techniques does not directly involve embracing ethical and moral values or promoting sustainability.

CO4: PO11: Practical implementation of HTML5 and CSS technologies does not inherently involve embracing ethical and moral values or promoting sustainability.

CO5: PO11: Applying HTML5 technologies to design websites does not directly involve embracing ethical and moral values or promoting sustainability.

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

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

Mapping of PO12 with All CO'S

CO1: PO12: Efficiently implementing data structures requires autonomy, responsibility, and accountability in managing projects and applying knowledge and skills independently.

CO2: PO12: Understanding memory allocation involves applying knowledge independently and managing projects effectively, demonstrating responsibility and accountability.

CO3: PO12: Analyzing proof techniques may contribute to autonomy and responsibility in learning contexts, though not as directly related to project management.

CO4: PO12: Practical implementation of HTML5 and CSS technologies may require autonomy and responsibility in managing web development projects, though not as directly related to independent application of knowledge.

CO5: PO12: Applying HTML5 technologies to design websites involves autonomy and responsibility in managing web projects, though not as directly related to independent application of knowledge.

CO6: PO12: Analyzing web page elements and attributes may contribute to autonomy and responsibility in learning contexts, though not as directly related to project management.

CO7: PO12: Creating web pages using CSS requires autonomy and responsibility in managing web projects, though not as directly related to independent application of knowledge.

Mapping of PO13 with All CO'S

CO1: PO13: Efficiently implementing data structures may not directly contribute to community engagement and service activities.

CO2: PO13: Understanding memory allocation basics is not directly related to community engagement and service.

CO3: PO13: Analyzing proof techniques may not directly involve community engagement and service.

CO4: PO13: Practical implementation of HTML5 and CSS technologies may not inherently involve community engagement and service activities.

CO5: PO13: Applying HTML5 technologies to design websites may not directly involve community engagement and service activities.

CO6: PO13: Analyzing web page elements and attributes may not directly involve community engagement and service activities.

CO7: PO13: Creating web pages using CSS may not directly involve community engagement and service activities.

SYLLABUS FOR S.Y.B.Sc. (Computer Science) Sem-III
(CBCS as per NEP 2.0 2024Pattern)
(w. e. from June, 2025)

Name of the Programme	**:**B.Sc.Computer Science
Program Code	: COS
Class	**:**S.Y.B.Sc.(Computer Science)
Semester	**:** III
Course Type	**:**Vocational Skill Course(VSC)
Course Code	**:**COS-204-VSC
Course Title	**:**Major Practical-II**(**Object Oriented Programming using C++)
No. of. Practicals	**:15**
No. of. Credits	**:02**

Course Objectives:

1. To introduce the fundamental concepts of Object-Oriented Programming (OOP) and its Principles.
2. To understand the concept of classes, objects, and methods in C++..
3. To explore the importance of constructors and destructors in object lifecycle management.
4. To analyze the concepts of function overloading and operator overloading for polymorphism.
5. To gain knowledge of inheritance and polymorphism to implement code reusability and modularity.
6. To understand encapsulation and abstraction for better data security.
7. To implement file handling in C++ for storing and retrieving data from files.

Course Outcomes:

Students will be able to:

CO1: Explain the basic concepts of OOPs such as classes, objects, methods, and data members.

CO2: Demonstrate the use of constructors and destructors in managing memory and object lifetime.

CO3: Apply function overloading and operator overloading to achieve compile-time polymorphism.

CO4: Implement different types of inheritance (single, multiple, hierarchical, multilevel, hybrid) for **code** reusability

CO5: Develop C++ programs that apply runtime polymorphism using virtual functions.

CO6: Illustrate the concept of encapsulation and abstraction for data hiding and access control.

CO7: Use file handling operations (read/write) in C++ for real-world applications.

Sr. No	Name of Assignments	No. of Practical's
1.	Assignment on Beginning with C++	3
2.	Assignment on Operators and Functions in C++	2
3.	Assignment on Class and Objects	2
4.	Assignment on Constructor and Destructor	2
5.	Assignment on Inheritance	2
6.	Assignment on Polymorphism	2
7.	Assignment on Working with Files	2

Mapping of this course with Programmed Outcomes

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

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

Justification of Mapping of PO1 with All CO'S

CO1:PO1: CO1 strongly mapped with PO1.
Understanding classes, objects, methods, and data members forms the foundation of Object-Oriented Programming, which is a key theoretical and practical area in computer science.
CO2:PO1: CO2 Moderately mapped with PO1.
Constructors and destructors help in memory management and object lifetime control, which contributes to a deeper understanding of programming principles.
CO3:PO1: CO3 Strongly mapped with PO1.Function overloading and operator overloading are essential for achieving compile-time polymorphism, which is a fundamental OOP concept that strengthens programming expertise.
CO4:PO1: CO4 Strongly related with PO1.Different types of inheritance are crucial for understanding code reusability, modularity, and design patterns, which are core OOP principles.
CO5:PO1: CO5 Strongly related with PO1.Runtime polymorphism using virtual functions is a key concept that enhances the understanding of dynamic behavior in OOP, strengthening the theoretical and practical grasp of programming.

CO6:PO1:CO6 Strongly related with PO1.Encapsulation and abstraction are fundamental

OOP principles that ensure data security, modularity, and efficient software design.
CO7:PO1: CO7 Moderately related with PO1.
File handling operations apply theoretical knowledge to real-world applications, providing practical experience in data storage and retrieval.

Justification of Mapping of PO2 with All CO'S

CO1:PO2: CO1 Moderately mapped with PO2.
Basic OOP concepts provide foundational programming knowledge but require further application in industry settings to gain practical expertise.
CO2:PO2: CO2 Stongly mapped with PO2.
Understanding constructors and destructors is essential for managing memory and object lifetime, which is a key professional skill in software development.
CO3:PO2: CO3 Strongly mapped with PO2.
Function and operator overloading enhance programming efficiency and are widely used in industry-standard coding practices.
CO4:PO2: CO4 Strongly related with PO2.
Different types of inheritance are crucial for writing reusable and maintainable code, aligning with professional software development practices.
CO5:PO2: CO5 Strongly related with PO2.
Runtime polymorphism using virtual functions is a fundamental technique in professional software engineering, enabling scalable and flexible applications
CO6:PO2:CO6 Strongly related with PO2.
Encapsulation and abstraction are essential for secure and modular programming, ensuring adherence to industry best practices.
CO7:PO2: CO7 Strongly related with PO2.
File handling is a necessary skill for managing data storage and retrieval in real-world applications, making it highly relevant to professional software development.

Justification of Mapping of PO3 with All CO'S

CO1:PO3: CO1 Partially mapped with PO3.
Basic OOP concepts lay the groundwork for software development but do not directly contribute to entrepreneurial skills.
CO2:PO3: CO2 Partially mapped with PO3.
Understanding memory management is essential for software efficiency but has limited direct impact on entrepreneurship.
CO3:PO3: CO3 Moderately mapped with PO3.
Function and operator overloading improve software efficiency and can contribute to innovative software solutions.
CO4:PO3: CO4 Moderately related with PO3.
Understanding inheritance helps in designing scalable and reusable software, which can be beneficial for entrepreneurial software projects.
CO5:PO3: CO5 Strongly related with PO3.
Runtime polymorphism allows for dynamic and adaptable software solutions, which are crucial for innovative product development.
CO6:PO3:CO6 Strongly related with PO3.
Encapsulation and abstraction ensure secure and modular software, which is vital for developing commercial and innovative applications.
CO7:PO3: CO7 Strongly related with PO3.
File handling is essential for data-driven applications and software solutions, which are often key components of entrepreneurial ventures.

Justification of Mapping of PO4 with All CO'S

CO1:PO4: CO1 Moderately mapped with PO4.
Understanding basic OOP concepts helps build a strong foundation for technical skills but requires further specialization for advanced problem-solving.
CO2:PO4: CO2 Strongly mapped with PO4.
Effective use of constructors and destructors enhances memory management skills, which are crucial for technical expertise in software development.
CO3:PO4: CO3 Moderately mapped with PO4.
Function and operator overloading improve problem-solving and analytical skills by enabling efficient code design and implementation.
CO4:PO4: CO4 Strongly related with PO4.
Implementing different types of inheritance strengthens technical and problem-solving skills by enabling code reusability and scalability.
CO5:PO4: CO5 Moderately related with PO4.
Runtime polymorphism enhances adaptability in programming and is essential for designing flexible and scalable software solutions.
CO6:PO4:CO6 Moderately related with PO4.
Encapsulation and abstraction contribute to problem-solving, security, and modularity, making them vital for technical competency.
CO7:PO4: CO7 Strongly related with PO4.
File handling skills are essential for managing data in real-world applications, improving technical proficiency and adaptability in software engineering.

Justification of Mapping of PO5 with All CO'S

CO1:PO5: CO1 Moderately mapped with PO5.
Understanding basic OOP concepts is fundamental but requires additional application for problem-solving in real-world scenarios.
CO2:PO5: CO2 Moderately mapped with PO5.
Managing memory and object lifetime using constructors and destructors enhances analytical reasoning and problem-solving in resource management.
CO3:PO5: CO3 Moderately mapped with PO5.
Function and operator overloading allow for efficient and optimized problem-solving, improving adaptability in coding.
CO4:PO5: CO4 Moderately related with PO5.
Implementing different inheritance types helps in structuring complex problems effectively, enhancing critical thinking and application skills.
CO5:PO5: CO5 Moderately related with PO5.
Runtime polymorphism provides flexibility in solving software design challenges, reinforcing analytical and problem-solving skills.
CO6:PO5:CO6 Moderately related with PO5.
Encapsulation and abstraction enable secure and modular programming, requiring critical thinking for designing robust systems.
CO7:PO5: CO7 Moderately related with PO5.
File handling operations are essential for data processing and management, which require analytical reasoning and problem-solving skills.

Justification of Mapping of PO6 with All CO'S

CO1:PO6: CO1 Moderately mapped with PO6.
Understanding basic OOP concepts helps in effectively communicating technical ideas, but practical collaboration is required for team-based problem-solving.
CO2:PO6: CO2 Partially mapped with PO6.

Memory management concepts are crucial for programming but do not directly contribute to communication or teamwork skills.
CO3:PO6: CO3 Moderately mapped with PO6.
Function and operator overloading require clear documentation and communication, aiding in collaborative coding environments.
CO4:PO6: CO4 Moderately related with PO6.
Implementing inheritance requires proper design and documentation, fostering collaboration in software development teams.
CO5:PO6: CO5 Strongly related with PO6.
Runtime polymorphism is essential for designing scalable systems that require team collaboration, code maintainability, and effective communication.
CO6:PO6:CO6 Strongly related with PO6.
Encapsulation and abstraction require effective documentation, discussions, and team coordination for software development.
CO7:PO6: CO7 Strongly related with PO6.
File handling operations are crucial in collaborative software projects, requiring structured data management and clear communication among team members.

Justification of Mapping of PO7 with All CO'S

CO1:PO7: CO1 Moderately mapped with PO7.
Understanding fundamental OOP concepts helps in formulating research questions related to software development methodologies.
CO2:PO7: CO2 Moderately mapped with PO7.
Exploring constructors and destructors aids in researching efficient memory management techniques and performance optimization.
CO3:PO7: CO3 Strongly mapped with PO7.
Function and operator overloading contribute to research in software optimization and efficiency improvements.
CO4:PO7: CO4 Strongly related with PO7.
Inheritance concepts support research in software design patterns, reusable code structures, and system architecture.
CO5:PO7: CO5 Moderately related with PO7.
Runtime polymorphism is crucial for research in dynamic programming, framework development, and software adaptability.
CO6:PO7:CO6 Moderately related with PO7.
Encapsulation and abstraction are key topics in research related to security, software modularity, and design principles.
CO7:PO7: CO7 Moderately related with PO7.
File handling techniques are vital for research in data storage, retrieval, and large-scale data processing methodologies.

Justification of Mapping of PO8 with All CO'S

CO1:PO8: CO1 Moderately mapped with PO8.
Learning basic OOP concepts requires self-directed exploration of programming paradigms and methodologies.
CO2:PO8: CO2 Moderately mapped with PO8.
Understanding constructors and destructors involves continuous learning of memory management techniques and best practices.
CO3:PO8: CO3 Moderately mapped with PO8.
Function and operator overloading require adapting to new programming techniques and continuously refining problem-solving skills.
CO4:PO8: CO4 Moderately related with PO8.

Implementing different inheritance types requires learners to explore multiple design patterns and improve code reusability strategies.
CO5:PO8: CO5 Moderately related with PO8.
Mastering runtime polymorphism necessitates independent learning of advanced object-oriented programming concepts.
CO6:PO8:CO6 Moderately related with PO8.
Encapsulation and abstraction encourage students to learn software security principles and access control mechanisms on their own.
CO7:PO8: CO7 Moderately related with PO8.
File handling in C++ requires students to explore different data storage techniques and apply them in real-world applications independently.

Justification of Mapping of PO9 with All CO'S

CO1:PO9: CO1 Partially mapped with PO9.
Understanding basic OOP concepts like classes, objects, and methods introduces students to structured programming, which is essential for developing technological skills.
CO2:PO9: CO2 Partially mapped with PO9.
Knowledge of constructors and destructors aids in efficient memory management, a fundamental skill for software development but not directly related to ICT or data analysis.
CO3:PO9: CO3 Partially mapped with PO9.
Function and operator overloading improve programming efficiency, indirectly contributing to technological proficiency.
CO4:PO9: CO4 Moderately related with PO9.
Implementing inheritance supports reusable and modular code design, which is important for software development and managing technological resources effectively.
CO5:PO9: CO5 Moderately related with PO9.
Understanding runtime polymorphism through virtual functions helps in building dynamic applications, contributing to proficiency in software development.
CO6:PO9:CO6 Partially related with PO9.
Encapsulation and abstraction improve data security and structured software development, indirectly contributing to digital skills.
CO7:PO9: CO7 Strongly related with PO9.
File handling (reading/writing data) is crucial for data processing and storage, directly aligning with PO9's focus on using ICT and analyzing data with appropriate software.

Justification of Mapping of PO10 with All CO'S
CO1:PO10: CO1 Partially mapped with PO10.
Understanding OOP concepts enables students to develop software that can be adapted to diverse user needs and cultural settings.
CO2:PO10: CO2 Partially mapped with PO10.
Managing memory and object lifetimes helps in designing efficient applications, which can support diverse user experiences.
CO3:PO10: CO3 Partially mapped with PO10.
Function and operator overloading allow for designing flexible and user-friendly applications that accommodate diverse user needs.
CO4:PO10: CO4 Moderately related with PO10.
Implementing inheritance promotes modular and reusable code, which helps in developing adaptable software for multicultural users.
CO5:PO10: CO5 Moderately related with PO10.
Runtime polymorphism allows creating software solutions that can be customized for diverse cultural and user preferences.
CO6:PO10:CO6 Moderately related with PO10.

Encapsulation and abstraction support the development of secure applications, ensuring inclusivity and data protection for all users.
CO7:PO9: CO7 Strongly related with PO9.
File handling is essential for real-world applications, enabling data management and access for users from different backgrounds, thus supporting inclusivity.

Justification of Mapping of PO11 with All CO'S
CO1:PO11: CO1 Partially mapped with PO11.
Understanding OOP concepts fosters structured programming, which can be used to develop ethical and sustainable software solutions.
CO2:PO11: CO2 Partially mapped with PO11.
Efficient memory management through constructors and destructors helps in optimizing resource usage, which aligns with sustainability goals.
CO3:PO11: CO3 Partially mapped with PO11.
Function and operator overloading enhance code efficiency, promoting better software development practices with optimized resource utilization.
CO4:PO11: CO4 Moderately related with PO11.
Inheritance promotes code reusability, reducing redundancy and supporting sustainable software development practices.
CO5:PO11: CO5 Moderately related with PO11.
Runtime polymorphism allows scalable and adaptable programming, which contributes to the development of ethical and sustainable systems.
CO6:PO11:CO6 Moderately related with PO11.
Encapsulation and abstraction improve data security and ethical software practices, ensuring responsible software usage.
CO7:PO11: CO7 Moderately related with PO11.
.File handling enables efficient data storage and retrieval, which can be applied to environmental monitoring, ethical data management, and sustainable computing practices.

Justification of Mapping of PO12 with All CO'S
CO1:PO12: CO1 Partially mapped with PO12.
Understanding basic OOP concepts provides foundational knowledge but does not directly contribute to autonomy and responsibility.
CO2:PO12: CO2 Moderately mapped with PO12.
Managing memory using constructors and destructors helps students develop responsibility in resource management, which is crucial for professional programming.
CO3:PO12: CO3 Moderately mapped with PO12.
Function and operator overloading improve efficiency and enable structured programming, promoting responsible software design.
CO4:PO12: CO4 Moderately related with PO12.
Implementing various types of inheritance fosters structured and reusable code, teaching students how to design and manage complex projects effectively.
CO5:PO12: CO5 Moderately related with PO12.
Runtime polymorphism using virtual functions helps in designing scalable applications, enhancing autonomy and accountability in software development.
CO6:PO12:CO6 Moderately related with PO12.
Encapsulation and abstraction promote data security and controlled access, ensuring responsible software development practices.
CO7:PO12: CO7 Moderately related with PO12.
File handling is crucial for real-world applications, reinforcing accountability in handling data storage and retrieval efficiently.

Justification of Mapping of PO13 with All CO'S

CO1:PO13: CO1 Partially mapped with PO13.
Understanding OOP basics lays the foundation for developing software that can be used in community services, but its direct impact is minimal.
CO2:PO13: CO2 Partially mapped with PO13.
Managing memory efficiently helps in creating reliable applications, which can indirectly benefit community projects.
CO3:PO13: CO3 Moderately mapped with PO13.
Using function and operator overloading enhances code efficiency, which can contribute to well-structured applications for societal needs.
CO4:PO13: CO4 Moderately related with PO13.
Implementing inheritance promotes reusable and maintainable code, which is beneficial for developing community-oriented applications.
CO5:PO13: CO5 Moderately related with PO13.
Runtime polymorphism helps in designing scalable applications, which can be useful for developing adaptable solutions for social causes.
CO6:PO13:CO6 Strongly related with PO13
Encapsulation and abstraction ensure secure and user-friendly applications, which are essential for community services like healthcare, education, and social platforms.
CO7:PO13: CO7 Strongly related with PO13.
File handling enables data storage and retrieval, which is crucial for applications in community services such as record-keeping in NGOs, healthcare, and education.

SYLLABUS (CBCS as per NEP 2020) FOR S.Y.B Sc. (Computer Science) Sem-III
(w. e. f. A.Y 2025-26)

Name of the Programme :B.Sc. (Computer Science)
Class **:** S.Y. B.Sc. (Computer Science)
Semester **:** III
Course Type **:** Field Project
Course Code **:** COS-205-FP
Course Name **:** Major Practical III (Field Project)
No. of Credits **:** 02

The format of Progress Report is:

Roll No. & Name of Student:	
Title of the Project:	
Project Guide Name:	

Sr. No.	Date	Details of Project Work	Project Guide Sign (With Date)
1			
2			
3			
4			
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8			
9			
10			
11			
12			

Head

Department of Computer Science

To carry out the field project work following guidelines should be used:

1. Field-based learning: Students should participate in field-based learning/projects under the supervision of field project coordinator.

2. A minimum of 30 hours of learning per credit is required.

3. Assignment of project topics to individual student or groups of students (2 or 3 students in one group) and one field project coordinator from the department will act as GUIDE for the students group.

4. The student should compile all the relevant data and carry out its analysis.

5. Write a project report in the standard format (2 Copies): Index, Chapter-1, Chapter-2, ….. Conclusion, References etc. The report should mention the clear OUTPUT drawn from the study. The typed project report should have minimum 25 pages, with font size 12 and line spacing of 1.5.

6. Submit the field project report with the field project coordinator signature to the department.

7. The Project can be platform, language and technology independent.

8. Project will be evaluated by the field project coordinator.

9. Assessment will be done weekly by the field project coordinator.

10. Evaluation will be on the basis of weekly progress of project work, progress report, oral, results and documentation and demonstration.

11. Students should fill their status of project work on the progress report and get the signature of project guide regularly.

12. Progress report should sharply focus how much time you have spent on specific task? You should keep progress report.

13. Project will not be accepted, if progress report is not submitted and all the responsibilities remain with student.

S.Y.B.Sc. (Computer Science) - Project : Key points to consider:

1. Frontend Technologies: Review the use of HTML, CSS, JavaScript, and frameworks like React, Angular, or Vue. Modern frameworks enhance interactivity and responsiveness.

2. Backend Technologies: Look for the backend language and framework, such as Node.js, Django, Ruby on Rails, or Spring. This helps understand how data processing and storage are handled.

3. Database: Identify the database type, whether it's SQL (e.g., MySQL, PostgreSQL) or NoSQL (e.g., MongoDB). This can impact data storage and scalability.

4. User Interface Design: A clean, intuitive, and engaging UI improves user experience. Components like menus, buttons, and icons should be well-designed and accessible.

5. Navigation and Structure: Easy navigation and a logical structure (headers, footers, sidebars) help users find information quickly.

6. Mobile Responsiveness: Verify that the website is mobile-friendly and adjusts smoothly across various screen sizes.

7. Loading Speed: Fast loading times enhance usability, and students with different internet speeds benefit from optimized performance.

8. Educational Resources: Does the site provide tutorials, coding challenges, articles, or project-based learning material that aligns with the curriculum?

9. Up-to-Date Information: Check if the content is regularly updated, as computer science topics evolve rapidly.

10. Content Depth and Scope: Ensure that topics are covered in enough depth to be useful but not overwhelming.

11. Programming Paradigms: The website may emphasize certain programming paradigms (e.g., OOP, functional programming) that could be highlighted in coding tutorials.

12. Data Structures and Algorithms: Sites for computer science students often include tutorials on key data structures and algorithms, which are foundational for coding and problem-solving.

13. Software Development Practices: Look for concepts like modularity, version control, code documentation, testing, and debugging, which prepare students for professional development.

14. Web Development Concepts: Topics like RESTful APIs, MVC architecture, state management, and component-based design are valuable for understanding web technologies.

15. HTTPS Encryption: A secure site (https://) is essential to protect users' data.

16. Authentication and Authorization: If there is a login feature, check if it follows security best practices (e.g., two-factor authentication, secure password storage).

17. Code Organization: Clean, modular, and well-organized code (if open source or available) helps students understand the structure.

18. Documentation: Well-documented code and explanations make it easier for students to learn and replicate concepts.

19. Feedback Options: Features like ratings or comment sections enable users to provide feedback, which helps improve the content.

20. Help and Support: Check if there are FAQs, chat support, or guidance to assist students with questions or issues

21. Clarity and Conciseness: The content should be easy to read, without complex jargon that might overwhelm students.

SYLLABUS (CBCS as per NEP 2024) FOR S. Y. B. Sc. (Computer Science)
Sem-III (w. e. from June, 2025)

Name of the Programme	**:** For S.Y. UG Sem-III
Program Code	: USCOS
Class	**:** S.Y.U.G.
Semester	**:**III
Course Type	**:** Minor for SY UG (TH)
Course Name	**:** HTML5 using CSS
Course Code	**:** COS-206-MN (D)
No. of Lectures	**: 30**
No. of Credits	**: 02**

Prerequisites:

- Basic knowledge of computers and its concepts.

Course Objectives:

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

Course Outcomes:

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

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

References:

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

Mapping of this course with Programme Outcomes

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

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

Justification of Mapping of PO1 with All CO'S

CO1: PO1: Constructing HTML documents with proper structures and utilizing HTML tags effectively directly demonstrates a profound understanding of foundational theories, principles, and methodologies in web development, aligning strongly with the comprehensive knowledge and understanding of the field of study.

CO2: PO1: Implementing specific HTML5 elements and various layout components requires a deep understanding of foundational concepts and key principles in web development, contributing significantly to the comprehensive knowledge and understanding of the field.

CO3: PO1: Applying the basics of CSS and understanding its role in styling HTML elements enhances the comprehension of foundational theories and methodologies in web design, closely linked with the broader multidisciplinary context of the field of study.

CO4: PO1: Applying CSS rules effectively to control the appearance of HTML elements demonstrates a profound understanding of CSS principles and methodologies, reinforcing the comprehensive knowledge and understanding of the field.

CO5: PO1: Designing web pages using HTML5 and CSS showcases a deep understanding of foundational theories, methodologies, and key concepts in web development, contributing significantly to the broader multidisciplinary context of the field of study.

CO6: PO1: Designing dynamic, interactive, and elegant websites requires a profound understanding of advanced concepts and principles in web development, aligning strongly with the comprehensive knowledge and understanding of the field.

CO7: PO1: Analyzing and exploring web pages to identify their elements and attributes demonstrates a deep understanding of foundational theories and methodologies in web development, reinforcing the comprehensive knowledge and understanding of the field.

Mapping of PO2 with All CO'S

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

Mapping of PO3 with All CO'S

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

to fostering innovation and understanding market dynamics but is only partially related to cultivating an entrepreneurial mindset.

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

Mapping of PO4 with All CO'S

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

Mapping of PO5 with All CO'S

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

involves problem-solving and analytical reasoning to achieve desired outcomes, directly related to the capacity for application and problem-solving.

CO5: PO5: Designing web pages using HTML5 and CSS necessitates problem-solving, analytical reasoning, and creativity, directly contributing to the capacity for application and problem-solving in web development.

CO6: PO5: Designing dynamic, interactive, and elegant websites requires problem-solving, creativity, and adaptability, directly linked to the capacity for application, problem-solving, and analytical reasoning.

CO7: PO5: Analyzing and exploring a web page demonstrates problem-solving, analytical reasoning, and adaptability, directly relevant to the capacity for application, problem-solving, and analytical reasoning in web development contexts.

Mapping of PO6 with All CO'S

CO1: PO6: Constructing HTML documents and utilizing HTML tags effectively may involve communication when collaborating with team members to ensure consistency and clarity in code, moderately related to effective communication in diverse teams.

CO2: PO6: Implementing specific HTML5 elements requires collaboration and communication within teams to discuss layout components and functionalities, moderately related to effective communication and collaboration.

CO3: PO6: Applying CSS basics to enhance web page aesthetics may involve communicating design preferences or requirements, moderately related to effective communication in conveying visual concepts.

CO4: PO6: Applying CSS rules effectively may involve communication with team members to ensure consistency in styling across web pages, moderately related to effective communication and collaboration.

CO5: PO6: Designing web pages using HTML5 and CSS may involve collaboration and communication to discuss design choices and functionalities, moderately related to effective communication and collaboration.

CO6: PO6: Designing dynamic, interactive, and elegant websites often requires collaboration and communication to align on design goals and functionalities, strongly related to effective communication and collaboration.

CO7: PO6: Analyzing and exploring a web page may involve communication within teams to discuss findings and implications for design changes, moderately related to effective communication and collaboration.

Mapping of PO7 with All CO'S

CO1: PO7: Constructing HTML documents and utilizing HTML tags effectively may involve some observational skills when analyzing existing web pages for inspiration or research purposes, partially related to research-related skills.

CO2: PO7: Implementing specific HTML5 elements requires some observational skills when analyzing different websites for functionality and layout ideas, partially related to research- related skills.

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

Mapping of PO8 with All CO'S

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

Mapping of PO9 with All CO'S

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

and control the appearance of HTML elements.

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

Mapping of PO10 with All CO'S

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

Mapping of PO11 with All CO'S

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

environmental awareness.

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

Mapping of PO12 with All CO'S

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

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

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

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

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

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

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

Mapping of PO13 with All CO'S

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

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

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

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

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

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

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

SYLLABUS (CBCS as per NEP 2024) FOR S. Y. B. Sc. (Computer Science)
Sem-III (w. e. from June, 2025)

Name of the Programme	**:** B.Sc. Computer Science
Program Code	**:** USCOS
Class	**:** S. Y. U.G.
Semester	III
Course Type	**:** Minor (PR)
Course Name	**:** Lab Course based on COS-206-MN(D)
Course Code	**:** COS-207-MN(D)
No. of Practicals	**:60**
No. of Credits	**:02**

Prerequisites:

- Basic knowledge of computers and its concepts.

Course Objectives:

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

Course Outcomes:

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

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

Mapping of PO's With CO's

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

1. **PO1 with all CO's :**

Each Course Outcome is strongly aligned with Program Outcome 1, indicating that the course effectively contributes to the development of graduates' comprehensive knowledge and understanding in their field of study.

2. **PO2 with all CO's:**

Strongly Agree (3): When a CO directly addresses the PO with significant emphasis. Moderately agree (2): When a CO partially addresses the PO or does so with less emphasis. Partially agree (1): When a CO only slightly addresses the PO or has minimal relevance.

3. **PO3 with all CO's :**

Each Course Outcome (CO) contributes equally to the development of an entrepreneurial mindset and knowledge, as they all provide foundational skills necessary for web development, which could be applied in entrepreneurial endeavours. Therefore, each CO is given a weightage of 1, indicating a partial agreement with the Program Outcome.

4. **PO4 with all CO's :**

The weightage is distributed based on how each Course Outcome contributes to the

demonstration of specialized skills and competencies relevant to the field of study. Weightage 3 is assigned to CO5 and CO6 as they directly address the proficiency in technical skills, analytical abilities, problem-solving, effective communication, and leadership in web design. CO1 to CO4 are assigned weightage 2 as they provide the foundational knowledge and skills necessary for web development, contributing to the overall proficiency. CO7 is given a weightage of 2 as it enhances analytical abilities and problem-solving skills by requiring students to analyse and explore web pages.

5. PO5 with all CO's :

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

6. PO6 with all CO's :

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

7. PO7 with all CO's :

CO7 is given a weightage of 2 as it directly contributes to the development of observational and inquiry skills, formulation of research questions, and utilization of appropriate methodologies for data collection and analysis. CO1 to CO6, while indirectly related to research-related skills, may involve elements of research methods and reporting findings but to a lesser extent compared to CO7.

8. PO8 with all CO's :

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

9. PO9 with all CO's :

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

10 PO10 with all CO's :

Each Course Outcome (CO) is assigned a weightage of 1, indicating a partial agreement with the Program Outcome. While the skills learned in web development may indirectly contribute to multicultural competence, inclusive spirit, and empathy, the direct relationship is not as strong as with other outcomes such as technical proficiency or problem-solving skills.

11. PO11 with all CO's :

Each Course Outcome (CO) is assigned a weightage of 1, indicating a partial agreement with the Program Outcome. While the skills learned in web development may indirectly contribute to ethical values and environmental awareness (e.g., through the responsible use of technology), the direct relationship is not as strong as with other outcomes such as

technical proficiency or problem-solving skills.

12. PO12 with all CO's :

CO5 and CO6 are assigned a weightage of 3 as they directly involve applying knowledge and skills independently, managing projects effectively, and demonstrating responsibility and accountability in work and learning contexts, aligning strongly with PO12. CO1 to CO4 contribute to these outcomes to a slightly lesser extent but still significantly, hence they are given a weightage of 2.

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

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

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

(w. e. f. A.Y 2025-26)

Name of the Program	: B.Sc. Computer Science
Program Code	: USCOS
Class	: S.Y. B.Sc. (Computer Science)
Semester	: III
Course Type	: Open Elective (TH)
Course Name	: Areas in Computer Science
Course Code	: COS-208-OE
No. of Lectures	: 30
No. of Credits	: 02

A) Course Objectives:

1 - To understand and gain knowledge of Computer.

2 - To understand and solve functional and procedural problems.

3 – To understand working of Database

4 - Understand and working of OS.

5 – To understand basic Software Engineering.

6 - use basic of Database.

7 - To understand the Emerging Technologies

B) Course Outcomes:

CO 1 - To understand Basic Concept of Database System.

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

CO 3 - To learn Function of Operating System.

CO 4 - To learn what is Emerging Technologies.

CO 5 - To learn different Emerging Technologies.

CO 6 - To learn about the Application using Emerging Technologies

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

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

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

Online Links:

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

Reference Books:

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

Course Outcomes	Programme Outcomes (POs)												
	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	2	1	2	2	1	1	2	3	1	1	2	1
CO2	3	3	2	3	3	3	2	3	2	2	2	3	2
CO3	3	2	1	2	2	1	1	2	2	1	1	2	1
CO4	2	2	2	2	2	2	2	3	3	2	2	2	2
CO5	2	2	2	2	2	2	2	3	3	2	2	2	2
CO6	2	3	3	3	3	3	2	3	3	3	3	3	3
CO7	3	3	2	3	3	3	2	2	2	2	2	3	2

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

Course Objectives (CO) and Program Outcomes (PO) Mapping:
Justification of PO1 to ALL COs :

CO 1 – PO 1 Understanding databases is fundamental to fields like Computer Science and Information Systems. It involves core principles of data organization, management, and retrieval.
CO 2– PO 1 Software engineering concepts form the backbone of creating, managing, and maintaining software systems. Learning these concepts ties directly to methodologies used in the field.
CO 3 – PO 1 Understanding how operating systems work is crucial for students to grasp the foundational principles of computing and how software interacts with hardware and other resources.
CO 4 – PO 1 Emerging technologies represent the forefront of technological advancements and are critical in understanding how the field is evolving.
CO 5 – PO 1 This extends the previous CO by diving deeper into specific emerging technologies, which are essential to understanding the future direction of the field.
CO 6 – PO 1 Learning how to apply emerging technologies connects the theoretical understanding with real-world implementation, thus reinforcing the broader multidisciplinary context.
CO 7– PO 1 Understanding the software engineering life cycle is key to applying methodologies and principles in real-world scenarios, directly tied to the understanding of the field.

Justification of PO2 to ALL COs :

CO 1 – PO 2 Understanding databases is foundational in fields like Computer Science and Information Systems. The ability to apply these concepts in practical scenarios (e.g., designing databases, data management) aligns well with real-world professional tasks.
CO 2 – PO 2 Software engineering concepts directly relate to professional practice in the tech industry, covering methodologies, industry standards, and best practices for developing software.
CO 3 – PO 2 Operating systems are fundamental to understanding how software interacts with hardware and how the system works in professional environments. Knowledge of OS principles helps in troubleshooting and optimizing system performance, which is crucial for real-world tasks.
CO 4 – PO 2 Emerging technologies are becoming increasingly relevant in professional settings, and knowledge about them helps graduates stay updated with industry trends.
CO 5 – PO 2 This CO builds on the previous one, broadening knowledge about various emerging technologies. This is useful for staying relevant and innovative in professional settings**.**
CO 6 – PO 2 Learning to apply emerging technologies ties into real-world applications, directly related to professional practice and problem-solving in industry.
CO 7 – PO 2 The software engineering life cycle directly connects to the professional and procedural knowledge that industry professionals must apply in their work.

Justification of PO3 to ALL COs :

CO 1 – PO 3 While databases are essential to technology and business operations, this CO focuses on foundational knowledge rather than entrepreneurial skills such as opportunity identification or business principles.

CO 2 – PO 3 Software engineering concepts play a significant role in developing products and solutions that could lead to entrepreneurial ventures. Understanding how to develop software can support the creation of innovative products.

CO 3 – PO 3 The function of operating systems is important in understanding how software and hardware work together, but this knowledge doesn't inherently encourage entrepreneurial skills like identifying business opportunities or risk management.

CO 4 – PO 3 Emerging technologies represent opportunities for innovation and can serve as the foundation for new entrepreneurial ventures. Understanding new technologies opens the door to spotting trends and developing innovative business ideas.

CO 5 – PO 3 Similar to CO4, learning about various emerging technologies enables students to spot new opportunities and potential business ventures.

CO 6 – PO 3 The application of emerging technologies directly connects to innovation and entrepreneurial ventures. Understanding how to apply these technologies can lead to identifying new business opportunities or developing innovative solutions.

CO 7 – PO 3 The software engineering life cycle is key to turning an entrepreneurial idea into a viable product or service. It also involves elements of project management, risk management, and iterative development, which are crucial in entrepreneurship.

Justification of PO4 to ALL COs :

CO 1 – PO 4 Understanding databases is fundamental to developing technical skills in data management. It also enhances analytical abilities and problem-solving skills in database design and optimization.

CO 2 – PO 4 Software engineering involves complex problem-solving, analytical thinking, and collaboration. It emphasizes technical proficiency, leadership in managing software projects, and communication within teams.

CO 3 – PO 4 Understanding how operating systems function is a technical skill that enhances analytical thinking and problem-solving abilities, especially when troubleshooting or optimizing system performance.

CO 4 – PO 4 Emerging technologies are essential for fostering innovation and adaptability. They challenge students to keep up with new trends and adapt to changes, although this CO doesn't directly address communication or leadership.

CO 5 – PO 4 Learning about a variety of emerging technologies equips students with the ability to innovate and adapt to new trends, which is critical in the tech industry.

CO 6 – PO 4 This CO is directly aligned with innovation, problem-solving, and technical proficiency as students apply emerging technologies in practical settings. It also requires adaptability to use new tools and frameworks.

CO 7 – PO 4 The software engineering life cycle is directly tied to problem-solving, technical skills, and leadership in managing projects. It also requires effective communication during each phase of the project.

Justification of PO5 to ALL COs :

CO 1 – PO 5 Understanding the basic concepts of databases allows students to apply theoretical knowledge to real-world problems, such as designing and managing databases. This CO also enhances

problem-solving skills related to data management.

CO 2 – PO 5 Software engineering concepts are highly relevant to problem-solving and analytical reasoning, especially when developing solutions that meet user needs or business requirements. It also requires creativity and the ability to adapt and take risks in the development process.

CO 3 – PO 5 Understanding the function of operating systems helps students solve technical problems related to system performance, optimization, and troubleshooting. It also contributes to the analytical reasoning required to manage system resources effectively.

CO 4 – PO 5 Learning about emerging technologies involves staying up-to-date with innovations and being adaptable. Students develop the ability to solve complex problems by leveraging new technologies, and this CO promotes critical thinking and creativity.

CO 5 – PO 5 This CO helps students develop an understanding of new technologies that can be applied in solving real-world problems. It enhances critical thinking and the ability to analyze and solve problems using emerging tools.

CO 6 – PO 5 Applying emerging technologies in real-world settings directly contributes to problem-solving and critical thinking. It involves practical application, the ability to analyze data, and creativity in developing new solutions.

CO 7 – PO 5 Understanding the software engineering life cycle helps students to solve complex problems step-by-step, apply knowledge to real-world projects, and use analytical reasoning to develop effective solutions throughout a project's life cycle.

Justification of PO6 to ALL COs :

CO 1 – PO 6 Understanding databases is foundational but does not directly address communication or collaboration. However, conveying database concepts to others or working in a team on a database project can improve communication skills.

CO 2 – PO 6 Software engineering concepts often involve working in teams, collaborating on projects, and communicating effectively in writing (e.g., documentation) and orally (e.g., team discussions). It also emphasizes leadership in managing software development processes.

CO 3 – PO 6 Understanding operating systems contributes to communication in technical contexts, particularly when explaining system functions or troubleshooting. However, it does not inherently emphasize collaboration or leadership.

CO 4 – PO 6 Learning about emerging technologies may require the ability to communicate complex ideas about new technologies effectively. It could involve discussions in diverse teams, fostering collaboration, and communication around the potential applications of new technologies.

CO 5 – PO 6 Learning different emerging technologies enhances the ability to communicate complex technical information. Collaboration is key when applying new technologies in real-world scenarios, and this CO promotes adaptability and teamwork in applying new tools.

CO 6 – PO 6 Applying emerging technologies often involves working in teams, solving real-world problems together, and effectively communicating ideas to stakeholders. This CO fosters both communication skills and collaboration in applying new technologies.

CO 7 – PO 6 The software engineering life cycle requires collaboration throughout different phases of a project. Effective communication is key in this process, especially when coordinating with team members and stakeholders and documenting project progress.

Justification of PO7 to ALL COs :

CO 1 – PO 7 Understanding the basic concept of database systems is foundational for research involving data collection, management, and analysis. However, it doesn't directly focus on formulating research questions or designing a research methodology.

CO 2 – PO 7 Software engineering concepts often involve methodologies that could be used in research projects. For example, in developing software tools for data collection or analysis. However, it does not focus on formulating research questions or conducting research.
CO 3 – PO 7 Understanding operating systems is important in research that involves system-level data collection or analysis. It is, however, not primarily concerned with formulating research questions or using formal research methodologies.
CO 4 – PO 7 Learning about emerging technologies promotes curiosity and inquiry, which are vital for research. However, it does not directly engage with the research process like formulating research questions or data collection**.**
CO 5 – PO 7 This CO introduces students to various technologies, fostering inquiry into new fields. However, like CO4, it does not directly focus on research question formulation, data collection, or research ethics.
CO 6 – PO 7 Applying emerging technologies in practical scenarios may require research methodologies, particularly when exploring new use cases or solving research problems. However, this CO is more about the application than about conducting formal research.
CO 7 – PO 7 The software engineering life cycle involves structured phases that can be applied to research projects, particularly in the development of tools for data collection and analysis. However, this CO does not focus on the formulation of research questions or ethics**.**

Justification of PO8 to ALL COs :
CO 1 – PO 8 Understanding database systems requires students to explore foundational concepts that they can apply to real-world scenarios. This understanding encourages self-learning and goal setting for further exploration and advanced topics.
CO 2 – PO 8 Software engineering concepts teach structured approaches to problem-solving, which require students to continuously learn and adapt as they face new challenges. Software engineering encourages self-directed learning in real-world applications and projects.
CO 3 – PO 8 Understanding operating systems often requires independent learning of advanced topics like system processes and resource management. However, it does not inherently focus on adapting to rapidly changing demands or setting long-term goals.
CO 4 – PO 8 Learning about emerging technologies encourages self-directed learning and continuous adaptation as students explore and keep up with new developments in the tech field.
CO 5 – PO 8 As with CO4, learning about different emerging technologies requires students to stay updated with the latest trends and adapt to changing demands in the technology field.
CO 6 – PO 8 Applying emerging technologies requires students to not only learn about them but also adapt and apply them to solve real-world problems, which involves setting learning goals and adapting as needed.
CO 7 – PO 8 The software engineering life cycle is a structured process, but it also requires students to learn independently and adapt to different phases of software development. Students must be able to set goals for project management, testing, and delivery.

Justification of PO9 to ALL COs :
CO 1 – PO 9 Understanding database systems involves using ICT tools (like DBMS software) to structure, store, and analyze data. This CO supports learning how to work with database management software, which is key for data analysis.
CO 2 – PO 9 Software engineering concepts often involve using software tools for design, development, testing, and management (e.g., version control, testing frameworks). This CO supports

digital proficiency, but it doesn't directly involve data analysis.
CO 3 – PO 9 Operating systems are foundational to understanding how hardware and software interact, making this CO relevant for using ICT tools effectively. It involves using operating system functions, but data analysis tools may not be the focus.
CO 4 – PO 9 Learning about emerging technologies encourages familiarity with ICT tools and software platforms. It may also involve exploring new tools for data analysis and information retrieval.
CO 5 – PO 9 Learning about different emerging technologies will enhance students' proficiency with a broad range of ICT tools and software for tasks like data analysis and information processing.
CO 6 – PO 9 Applying emerging technologies usually requires students to work with advanced software tools and ICT solutions to solve real-world problems, which directly involves data analysis and information access**.**
CO 7 – PO 9 Understanding the software engineering life cycle involves using various ICT tools for project management, design, development, and testing, which may not directly focus on data analysis but contributes to digital proficiency**.**

Justification of PO10 to ALL COs :
CO 1 – PO 10 Understanding database systems does not inherently involve engaging with multicultural teams or considering diverse perspectives. It is primarily focused on technical and theoretical knowledge.
CO 2 – PO 10 Software engineering concepts can be learned and applied in diverse team settings, especially when working in multinational teams on large projects. The ability to collaborate and lead teams can develop, though it isn't a central focus of this CO.
CO 3 – PO 10 Operating systems are technical concepts that generally do not involve direct engagement with multicultural teams or diverse perspectives. It's more about understanding systems and processes rather than human interaction.
CO 4 – PO 10 Emerging technologies are often global in nature and impact diverse groups of people. Learning about these technologies may encourage empathy and an inclusive spirit, particularly in terms of understanding how technologies impact various cultures and communities.
CO 5 – PO 10 Like CO4, understanding various emerging technologies can require engagement with diverse teams and stakeholders from different cultural backgrounds, which can foster multicultural competence and inclusivity**.**
CO 6 – PO 10 This CO involves applying emerging technologies, which may require collaboration in diverse teams and working in multicultural settings to ensure that the applications are appropriate and accessible to a global audience. The collaborative nature can foster empathy and inclusivity.
CO 7 – PO 10 The software engineering life cycle involves multiple stages of team collaboration, and large projects are often executed in diverse, multicultural teams. While the life cycle is more focused on processes, empathy and inclusivity can be developed through teamwork in this context.

Justification of PO11 to ALL COs :
CO 1 – PO 11 Understanding database systems primarily focuses on the technical aspects of data management. While it may indirectly involve ethical issues related to data privacy, security, and the responsible use of information, it does not directly address sustainability or environmental conservation.
CO 2 – PO 11 Software engineering often involves ethical considerations, especially related to privacy, security, and responsible software development practices. It may also involve considerations for sustainable and efficient software solutions. However, it does not inherently focus on environmental awareness.

CO 3 – PO 11 Operating systems are fundamental in managing hardware and software resources, but ethical and environmental issues related to OS design, such as energy efficiency and hardware optimization, may be considered. However, this CO does not directly address sustainability or environmental awareness.
CO 4 – PO 11 Emerging technologies often present ethical challenges, particularly regarding their impact on society, privacy, and the environment. Learning about these technologies may involve understanding their potential benefits and harms, including sustainability issues related to their use.
CO 5 – PO 11 Emerging technologies can significantly impact society and the environment, and it is important to consider their ethical and sustainable use. However, this CO's primary focus is on the technologies themselves rather than the broader social and environmental implications.
CO 6 – PO 11 This CO likely includes learning about technologies that can have both positive and negative impacts on the environment. It may involve addressing issues related to sustainability, ethical deployment, and the responsible use of new technologies.
CO 7 – PO 11 Applying emerging technologies often requires ethical decision-making, especially regarding their impact on society, the environment, and sustainability. This CO is highly relevant to issues of responsible technology deployment and environmental conservation.

Justification of PO12 to ALL COs :

CO 1 – PO 12 Understanding basic database concepts is a fundamental skill. While it is important to have independent knowledge in this area, the CO doesn't directly involve project management or high levels of responsibility and accountability.
CO 2 – PO 12 Software engineering concepts are essential for managing software projects effectively. This CO encourages independent problem-solving and responsibility for the design, development, and implementation of software systems.
CO 3 – PO 12 Understanding operating systems can be done independently and involves applying this knowledge in various work contexts, but it does not emphasize project management or high levels of responsibility.
CO 4 – PO 12 Learning about emerging technologies can be done independently, and it often requires taking responsibility for keeping up with new trends and integrating new technologies into projects. However, this CO does not directly focus on managing projects.
CO 5 – PO 12 Learning about different emerging technologies contributes to independent decision-making and taking responsibility for selecting and integrating technologies into solutions. However, it does not inherently involve managing complex projects.
CO 6 – PO 12 This CO involves applying emerging technologies, which requires independence, responsibility, and accountability. The application of new technologies typically requires managing projects effectively and taking ownership of the outcomes.
CO 7 – PO 12 Understanding the software engineering life cycle directly relates to project management, where responsibility and accountability are critical. This CO promotes independent thinking and the management of projects from conception through to delivery and maintenance.

Justification of PO13 to ALL COs :

CO 1 – PO 13 While understanding the basic concepts of a database system is essential for many technical careers, it does not directly engage with community service or societal well-being unless applied to community-based projects like public health databases or community service systems.
CO 2 – PO 13 Software engineering concepts can be applied to develop software solutions that benefit society, including applications for social good, such as platforms for education, healthcare, or community services. It has a moderate potential for involvement in community-engaged activities.
CO 3 – PO 13 Understanding the function of operating systems is a technical skill and does not

directly relate to community engagement or societal well-being. However, efficient and secure operating systems can underpin systems that support community services.

CO 4 – PO 13 Emerging technologies often provide opportunities to develop solutions for social good, such as using AI or blockchain for community services, public health initiatives, or sustainable development projects. This CO can indirectly relate to societal well-being by fostering innovation for the public good.

CO 5 – PO 13 Similar to CO4, learning about different emerging technologies allows graduates to identify opportunities for using these technologies in community development or service, such as in environmental monitoring, health informatics, or social services. It has a moderate connection to community service.

CO 6 – PO 13 This CO has significant potential for community engagement. The application of emerging technologies in real-world settings can directly contribute to societal well-being, such as by creating software that supports public health, education, or environmental sustainability.

CO 7 – PO 13 The software engineering life cycle can be applied to develop systems that serve the community, such as those aimed at improving public services, healthcare, education, and social infrastructure. A focus on the life cycle can support long-term community engagement.

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

(w. e. f. A.Y 2025-26)

Name of the Program: B.Sc. Computer Science
Program Code : USCOS
Class : S.Y. B.Sc. (Computer Science)
Semester : III
Course Type :Subject Specific Indian Knowledge System (IKS) (TH)
Course Name : Indian Knowledge Systems and Evolution in Computer Science
Course Code : COS-209-IKS
No. of Lectures : 30
No. of Credits : 02

A) Course Objectives:

1. Students will understand about the rich heritage of Indian Knowledge systems.
2. Students will explore the contributions of ancient Indian scholars to science and technology.
3. Students will gain knowledge about the history of computers and programming languages.
4. Students will study the features of scripting languages.
5. Students will study the features of different types of operating systems.
6. Students will study the features clouds.
7. Students will know the current trends in Computer Science.

B) Course Outcomes:

After completing this course, students will be able to

1. Understand about the rich heritage of Indian Knowledge Systems.
2. Integrate traditional Indian knowledge with modern computer science concepts.
3. Categorize the programming languages based on its features.
4. Compare the programming languages based on program structure.
5. Distinguish among different scripting languages based on its features.
6. Compare among different types of Operating Systems.
7. Compare among different types of cloud.
8. Compare among recent computing techniques.

Lecture Plan:

1. **Introduction to Indian Knowledge Systems (IKS)** **[6]**
   - Overview of IKS and its relevance to modern education.
   - Contributions of ancient Indian scholars.
   - Study of ancient algorithms and their relevance today.
2. **Indian Contributions to Linguistics and AI** **[8]**
   - Panini's grammar and its influence on computational linguistics.
   - Applications in natural language processing.
   - Integrating values and ethics in technological development.

- Concepts from Indian philosophy and their application in artificial intelligence.

3. **Early computing devices and early years [6]**
   - Early computing devices (Abacus, Pascal adding machine, Leibniz calculator, Difference Engine)
   - Early inventors (Charles Babbage, Ada Lovelace, George Boole, Dr. Herman Hollerith, John Von Neumann, Howard Aiken)
   - The Turing Machine (mathematical model) : Concept, Example
   - First programmable computes – Colossus, ENIAC
   - Solid State Transistors (1947) and emergence of second generation of computers
   - High Level Programming Languages: COBOL, FORTRAN, LISP and their features
   - Program structure in COBOL, FORTRAN and LISP
   - Invention of Integrated Circuits by Kilby and Noyce
4. **Middle years and moving towards future [10]**
   - BASIC language
   - Invention of ARPANET
   - Development of TCP/IP (Vint Cerf and Bob Kahn) and its features
   - Launching of Apple-I(1976) and Apple-II(modern PC) (1977)
   - VLSI
   - Development of Pascal and its features
   - Evolution of C language (1972) from B (1969), BCPL (1967), ALGOL 68(1968) and its features
   - Development of Prolog language (1972) and its features
   - Development of SQL by IBM (1972) and its features
   - Emergence of UNIX OS
   - Rise of the Operating Systems (Linux, Microsoft Windows, Solaris, Mac OS)
   - Evolution of C++ from C with classes (C + Simula 67)
   - The Word Wide Web (www) and its importance
   - Development of Python, R, Java
   - Features and applications of Python, R, Java
   - Features and applications of PHP, JavaScript, VBScript, ASP, JSP
   - Emergence of Cloud Computing, Types of Cloud
   - Artificial Intelligence: Machine Learning, Deep Learning
   - Applications of Artificial Intelligence
   - Internet of Things (IoT), Image Processing

Examination Pattern / Evaluation Pattern

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

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

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

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