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

T.Y.B.Sc.(Computer Science) Semester -VI

For Department of Computer Science

Tuljaram Chaturchand College, Baramati

Choice Based Credit System Syllabus (2022 Pattern)

To be implemented from Academic Year 2024-2025

Programs Outcome For B. Sc. (Computer Science) (2022 Pattern)

PO1: Apply fundamental principles and methods of Computer Science to a wide range of applications.

PO2: Design, correctly implement and document solutions to significant computational problems.

PO3: Impart an understanding of the basics of our discipline.

PO4: Prepare for continued professional development.

PO5: Understand the impact of the IT analyst solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

PO6: Develop proficiency in the practice of computing.

PO7: Develop the capacity to study and research independently that will help to develop skills for transition to employment in hardware/software companies.

Class: F.Y.B.Sc. (Computer Science)			
Semester I		**Semester II**	
UCSCO111	Basic Programming using C	UCSCO121	Advanced Programming using C
UCSCO112	DBMS-I	UCSCO122	DBMS-II
UCSCO113	Lab. Course I : Basic programming using C	UCSCO123	Lab. Course I : Advanced Programming using C
UCSCO114	Lab. Course II : DBMS I	UCSCO124	Lab. Course II : DBMS II
Physical Education			

Class :S.Y.B.Sc. (Computer Science) W.e.f. 2023-2024			
Semester III		**Semester IV**	
UCSCO231	Data Structure using C	UCSCO241	Object Oriented Concepts using Java
UCSCO232	Introduction to Web Technology	UCSCO242	Software Engineering Principles and Techniques
UCSCO233	Lab. Course I : based on UCSCO231	UCSCO243	Lab Course based on UCSCO241
UCSCO234	Lab. Course II : based on UCSCO232	UCSCO244	Lab Course based on UCSCO242 with Mini Project
Certificate Course I		Certificate Course II	
Environment Science (EVS) An Educational Trip conduct in IV semester			

Class: T.Y.B.Sc. (Computer Science) W.e.f. 2024-2025			
Semester V		**Semester VI**	
UCSCO351	System Programming &Operating System	UCSCO361	Advanced Operating System
UCSCO352	Theoretical Computer Science	UCSCO362	Compiler Construction
UCSCO353	Foundation of Computer Networking	UCSCO363	Computer Network & Network Security
UCSCO354	Basics of Web Development	UCSCO364	Advanced Web Development
UCSCO355	Advanced Programming in Java	UCSCO365	Advanced Java Technologies – Frameworks
UCSCO356	Object Oriented Software Engineering	UCSCO366	Software Metrics & Project Management
UCSCO357	Lab Course I: Based on UCSCO351	UCSCO367	Lab Course I: Based on UCSCO361
UCSCO358	Lab Course II: Based on UCSCO355	UCSCO368	Lab Course II: Based on UCSCO365 & Mini Project using JAVA
UCSCO359	Lab Course III: Based on UCSCO354	UCSCO369	Lab Course III: Based on UCSCO364 & Mini Project using PHP.
Certificate Course III		An Educational Trip conduct in this semester.	

T.Y.B.Sc.(Computer Science)Semester- VI

Credit Structure & Syllabus

(Academic Year 2024-2025, Autonomous)

Course Structure for T. Y. B. Sc. (Computer Science) Sem-V & VI

Subject: Computer Science

Sem	Paper Code	Title of Paper	No. of Credits	Exam	Marks
V	UCSCO351	System Programming &Operating System	3	I / E	60 + 40
	UCSCO352	Theoretical Computer Science	3	I / E	60 + 40
	UCSCO353	Foundation of Computer Networking	3	I / E	60 + 40
	UCSCO354	Basics of Web Development	3	I / E	60 + 40
	UCSCO355	Advanced Programming in Java	3	I / E	60 + 40
	UCSCO356	Object Oriented Software Engineering	3	I / E	60 + 40
	UCSCO357	Lab Course I: Based on UCSCO351	2	I / E	60 + 40
	UCSCO358	Lab Course II: Based on UCSCO355	2	I / E	60 + 40
	UCSCO359	Lab Course III: Based on UCSCO354	2	I / E	60 +40
		Certificate Course - III	2	---	----
VI	UCSCO361	Advanced Operating System	3	I / E	60 + 40
	UCSCO362	Compiler Construction	3	I / E	60 + 40
	UCSCO363	Computer Networks and Network Security	3	I / E	60 + 40
	UCSCO364	Advanced Web Development	3	I / E	60 + 40
	UCSCO365	Advanced Java Technologies – Frameworks	3	I / E	60 + 40
	UCSCO366	Software Metrics & Project Management	3	I / E	60 + 40
	UCSCO367	Lab Course I: Based on UCSCO361	2	I / E	60 + 40
	UCSCO368	Lab Course II: Based on UCSCO365 & Mini Project using JAVA	2	I / E	60 + 40
	UCSCO369	Lab Course III: Based on UCSCO364 & Mini Project using PHP.	2	I/E	60 +40
	An Educational Trip in this Semester				

SYLLABUS (CBCS) FOR T.Y.B. Sc. (Computer Science) (Sem- VI)

(w.e.f from Academic Year 2024-2025)

Class: T.Y.B.Sc. (Computer Science) (Sem-VI) **Paper Code: U**CSCO361
Title of Paper: Advanced Operating System Concepts **Paper:** I
Credit: 3 (4 Lectures/Week) **No. of lectures:** 48

Aim: To understand the design and implementation issues of Operating System.

Objectives:

- To understand design issues related to memory management and various related algorithms
- To understand design issues related to file management and various related algorithms.
- To understand the structures of different types of Operating System

Learning Outcome:

CO1: Understand memory management techniques, including virtual memory, paging, segmentation, and memoryallocation strategies.

CO2: Explore file system structures and operations, covering topics such as file organization, directory structures, andfile permissions.

CO3: Describe I/O devices and the mechanisms involved in managing input and output operations in an operatingsystem.

CO4: Explain the principles of device management, including device drivers, interrupt handling, and I/O buffering. CO5:Explore case studies of popular operating systems, such as Unix/Linux, Windows, and Distributed system, tounderstand real-world implementations and design decisions.

CO6: Know security challenges in distributed systems and real-time environments.

CO7: Understand the characteristics of RTOS, including task scheduling, response time analysis, and resourcemanagement.

Umt No.	Chapter name with Topics	No. of Lectures Required
1.	**Memory Management** 1.1.Background – Basic hardware, Address binding, Logical versus physical address space, Dynamic loading, Dynamic linking and shared libraries , Overlays 1.2 Swapping 1.3 Contiguous Memory Allocation – Memory mapping and protection, Memory allocation, Fragmentation MFT MVT 1.4 Paging – Basic Method, Hardware support, Protection, Shared Pages 1.5 Segmentation – Basic concept, Hardware 1.6 Virtual Memory Management – Background, Demand paging, Performance of demand paging, Page replacement – FIFO, OPT, LRU, MFU,LFU, MRU Second chance page replacement 1.7 Thrashing- Locality Model, Working Set Model, Prepaging, I/O Interlock,	**10**

2.	**File System** 2.1 Introduction 2.2 File Concepts- Tape based system, Disk based , File Attribute, Operations on file 2.3 Access Methods- Sequential access, Direct Access, Indexed Access 2.4 Directory Structure and Implementation- Single level directory, Two level directory, Tree structure directory, Acyclic Graph Directory. 2.5 File Structure 2.6 File System Mounting and File Sharing 2.7 Allocation Methods- Contiguous Allocation, Linked Allocation, Indexed Allocation 2.8 Free Space Management – Bitmap or Bit Vector, Linked List, Grouping, Counting	**08**
3.	**I/O Systems** 3.1 Introduction 3.2 I/O Hardware 3.3 Polling, 3.4 Interrupt 3.5 Direct Memory Access 3.6 Application I/O Interface 3.7 Kernel I/O Subsystem- I/O Scheduling, Buffering, Caching , Spooling and Device Reservation, Error Handling, 3.8 Disk Scheduling- First Come First Served (FCFS), Shortest Seek Time First (SSTF), Scan, C-Scan.	**08**
4.	**Introduction to Distributed Operating System & Architecture** 4.1 Distributed system design goals 4.2 Types of Distributed System 4.3 Architectural Styles- Layered Architecture, Object based architecture, Resource centered architectures, Event based Architecture 4.4 System Architecture- Centralized, Decentralized	08
5.	**Unix Kernel and File Management** 5.1 System Structure, User Perspective, Architecture of Unix Operating System 5.2 Buffer cache: Header, Buffer Pool, Retrieving, Reading and Writing Buffer 5.3 File Representation: inodes: Structure of file Directories, Path conversion to inode, superblock, inode assignment, allocation of disk blocks	**08**
6.	**Real Time Operating Systems and Mobile OS** 6.1 Characteristics of Real Time operating Systems, Classification of Real Time Operating Systems, Scheduling in RTOS: Clock driven: cyclic, Event driven: EDF and rateMonotonic scheduling. 6.2 Mobile OS: Architecture, Android OS, iOS, Virtual OS, Cloud OS and their design issues	**08**

Reference Books

1. Siberchatz, Galvin, Gagne Operating System Concepts - (8th Edition).
2. Pabitra Pal ChoudharyOperatingSystems : Principles and Design – (PHI Learning Private Limited)
3. Maurice J. Bach.The Design of the UNIX Operating System, PHI
4. Mahajan and Seema Shah,Distributed Computing 2ndEditionOXford.
5. MukeshSinghal, Niranjan G ShivaratAdvanced Concepts in Operating Systems

6. Rajkamal, Pedition Mobile Computing Oxford.
7. Jane W.S. Liu, Real Time Operating System Pearson.

Course Outcomes	Program Outcomes						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	1	1	1	1
CO2	2	2	2	1	1	1	1
CO3	2	2	2	1	1	1	1
CO4	2	3	2	1	1	1	1
CO5	1	3	3	1	3	2	1
CO6	3	3	2	2	2	1	1
CO7	3	3	3	1	1	1	1

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

PO1 with All COs

CO1: PO1: 3 (Strongly Related): Applying memory management techniques is integral to efficient IT applications,relying heavily on mathematical and computational principles.
CO2: PO1: 2 (Moderately Related): While understanding file systems is relevant to IT applications, the directapplication of mathematics and statistics may be moderate compared to other aspects.
CO3: PO1: 2 (Moderately Related): Describing I/O devices and mechanisms involves computer fundamentals but mayhave a moderate link to advanced mathematical or statistical concepts.
CO4: PO1: 2 (Moderately Related) : Explaining device management principles draws on computer fundamentals,moderately tying into mathematical and statistical aspects.
CO5: PO1: 1 (Partially Related) :Exploring case studies contributes to computer knowledge but may have limiteddirect application of advanced mathematics or statistics.
CO6: PO1: 3 (Strongly Related): Understanding security challenges involves applying mathematical and statisticalconcepts to address threats in distributed and real-time systems.
CO7: PO1: 3 (Strongly Related): Grasping the characteristics of RTOS necessitates applying mathematical principlesto optimize task scheduling, response times, and resource management.

PO2 with All COs

CO1: PO2: 3 (Strongly Related): Designing IT solutions requires a strong understanding of memory management, afundamental aspect critical to optimizing application performance.
CO2: PO2: 2 (Moderately Related): While understanding file systems is essential in solution design, the directapplication of the latest technologies and languages may be moderate compared to other aspects.
CO3: PO2: 2 (Moderately Related): Describing I/O devices and mechanisms is crucial in solution design, but the directlink to the latest technologies and languages may be moderate.
CO4: PO2: 2 (Moderately Related): Explaining device management principles contributes to solution design, but thedirect application of the latest technologies may be moderate.
CO5: PO2: 3 (Strongly Related): Exploring case studies informs solution design by incorporating real-worldimplementations and decisions using the latest technologies.
CO6: PO2: 3 (Strongly Related): Understanding security challenges is integral in designing secure IT solutions,aligning strongly with the use of the latest technologies.
CO7: PO2: 3 (Strongly Related): Grasping the characteristics of RTOS is crucial for designing real-time solutionsusing the latest technologies and languages.

PO3 with All COs

CO1 PO3: 2 (Moderately Related): Modern tools for system analysis and performance optimization often rely on astrong understanding of memory management techniques.

CO2:PO3: 2 (Moderately Related): Modern tools for version control, file analysis, and optimization benefit from agood understanding of file system structures.
CO3: PO3: 2 (Moderately Related): Tools for I/O profiling and optimization require an understanding of themechanisms involved in managing input and output operations.
CO4: PO3: 2 (Moderately Related): Modern tools for device debugging and optimization benefit from knowledge ofdevice management principles.
CO5: PO3: 3 (Strongly Related): Modern tools often incorporate insights from real-world case studies, enhancing theireffectiveness in system design and implementation.
CO6: PO3: 2 (Moderately Related): Modern tools for security analysis and implementation require an understanding ofsecurity challenges in distributed and real-time systems.
CO7: PO3: 3 (Strongly Related): Modern tools for developing real-time systems leverage a deep understanding ofRTOS characteristics for effective task scheduling and resource management.

PO4 with All COs

CO1: PO4: 1(Partially related): as memory management is more aligned with the core functionality of an operatingsystem rather than environmental and sustainability considerations.
CO2: PO4: 1 (Partially related): as file system structures and operations are essential components of an operatingsystem but have limited direct connection to environmental and sustainability aspects.
CO3:PO4: 1(Partially related): as I/O devices and mechanisms are crucial for system operation, but their direct link toenvironmental and sustainability aspects is limited.
CO4: PO4: 1(Partially related) as device management principles are integral to operating systems but do not have adirect connection to environmental and sustainability concerns.
CO5: PO4: 1 (Partially related) : as studying operating systems may not inherently focus on environmental andsustainability aspects.
CO6: PO4: 2 (Moderately related):as security challenges in distributed systems may have implications forenvironmental and sustainability concerns, but the direct connection is not strong.
CO7: PO4: 1:(Partially related) as real-time operating systems (RTOS) characteristics are more aligned withperformance and timing considerations than with environmental and sustainability factors.

PO5 with All COs

CO1: PO5: 1 (Partially related) as memory management primarily focuses on technical aspects rather than ethicalconsiderations.
CO2: PO5: 1 (Partially related) as file system structures and operations are more technical in nature and may notdirectly involve ethical considerations.
CO3: PO5: 1(Partially related) as I/O devices and mechanisms are essential technical components with limited directconnection to ethical considerations.
CO4: PO5: 1 (Partially related): as device management principles are primarily technical and may not have a strongethical dimension.
CO5: PO5: 3 (Strongly related): as understanding the ethical implications of design decisions in popular operatingsystems is crucial for a comprehensive analysis.
CO6: PO5: 2 (Moderately related): as security challenges may involve ethical considerations but are primarilytechnical in nature.
CO7: PO5: 1 (Partially related) as the characteristics of real-time operating systems are more technical and may notinherently involve ethical considerations.

PO6 with All COs

CO1: PO6: 1 (Partially related): as memory management is a technical skill that may not directly involve individual orteamwork aspects.
CO2: PO6: 1 (Partially related): as file system structures and operations are technical aspects with limited connection toindividual or teamwork considerations.

CO3: PO6: 1 (Partially related): as I/O devices and mechanisms are technical components with minimal directassociation with individual or teamwork skills.
CO4: PO6: 1(Partially related): as device management principles are technical and may not strongly involve individualor teamwork aspects.
CO5: PO6: 2 (Moderately related): as analyzing case studies may require collaboration and discussion, fosteringteamwork and individual skills.
CO6: PO6: 1 (Partially related): as understanding security challenges is more technical and may not directly involveindividual or teamwork skills.
CO7: PO6: 1 (Partially related): as the characteristics of real-time operating systems are technical and may not stronglyconnect with individual or teamwork aspects.

PO7 with All COs

CO1: PO7: 1 (Partially related): as memory management is a technical skill that may not directly align withinnovation, employability, or entrepreneurial skills.
CO2: PO7: 1(Partially related) as file system structures and operations are technical aspects with limited directconnection to innovation, employability, or entrepreneurial skills.
CO3: PO7: 1(Partially related): as I/O devices and mechanisms are technical components with minimal directassociation with innovation, employability, or entrepreneurial skills.
CO4: PO7: 1 (Partially related): as device management principles are technical and may not strongly involveinnovation, employability, or entrepreneurial skills.
CO5: PO7: 2 (Moderately related): as analyzing case studies may contribute to critical thinking and problem-solvingskills relevant to innovation and employability.
CO6: PO7: 1 (Partially related): as understanding security challenges is more technical and may not directly involveinnovation, employability, or entrepreneurial skills.
CO7: PO7:1(Partially related): as the characteristics of real-time operating systems are technical and may notstrongly connect with innovation, employability, or entrepreneurial skills.

SYLLABUS (CBCS) FOR T. Y. B. Sc. (Compute Science)

(Sem-VI)Academic Year 2024-2025

Class: T.Y. B. Sc.(Computer Science) (Sem.- VI) **Paper Code**: U**CSCO362**

Subject: Compiler Construction **Paper**: II

Credit: 3 **No. of lectures:** 48

Prerequisite:

• Theoretical Computer Science

Learning Objectives: Students successfully completing this course will be able:

• To understand design issues of a lexical analyzer and use of LEX tool

• To understand design issues of a parser and use of YACC tool

• To understand issues related to memory allocation

• To understand and design code generation schemes

Learning Outcome: Learning Outcome:

CO1: Students will demonstrate a comprehensive understanding of the purpose, importance, and functioningof compilers in software development.

CO2: Understand the various phases of a compiler and to develop skills in designing a compiler.

CO3: Students will be able to design and implement lexical analyzers capable of breaking down source codeinto tokens.

CO4: Students will construct syntax analyzers to generate abstract syntax trees (ASTs) from parsed code.

CO5: Students will generate intermediate code representations from the AST to facilitate optimization andfurther processing.

CO6: Students will apply various code optimization techniques, such as constant folding and loopoptimization, to enhance code efficiency.

CO7: Students will understand the roles of the front-end and back-end in a compiler and their contributionsto the compilation process.

Units	Topic Contents	No. of Lectures
Unit – I	**Introduction** Definition of Compiler, Aspects of compilation. The structure of Compiler. Phases of Compiler – Lexical Analysis, Syntax Analysis,Semantic Analysis, Intermediate Code generation, code optimization, code generation. Error Handling Introduction to one pass & Multipass compilers, crosscompiler, Bootstrapping.	**5**
Unit – II	**Lexical Analysis(Scanner)** Review of Finite automata as a lexical analyzer, Applications of Regular Expressions and Finite Automata(lexicalanalyzer, searching using RE), Input buffering, Recognition of tokens LEX: A Lexical analyzer generator (Simple Lex Program)	**5**

	3.4.2 FIRST& FOLLOW 3.4.3 Construction of LL(1) Parsing Table 3.4.4Parsing of a String using LL(1) Table 3.5 Bottom-Up Parsers 3.6 Operator Precedence Parser -Basic Concepts 3.6.1Operator Precedence Relations form Associativity & Precedence 3.6.2 Operator Precedence Grammar 3.6.3 Algorithm for LEADING &TRAILING(with ex.) 3.6.4Algorithm for Operator Precedence Parsing (with ex.) 3.6.5Precedence Functions 3.7 Shift Reduce Parser 3.7.1 Reduction, Handle, Handle Pruning 3.7.2 Stack Implementation of Shift Reduce Parser (with examples) 3.8 LR Parser 3.8.1Model 3.8.2Types [SLR(1), Canonical LR, LALR] Method & examples. 3.9 YACC (from Book 3) –program sections, simple YACC program for expression evaluation	
Unit -IV	**Syntax Directed Definition** 4.1 Syntax Directed Definitions(SDD) 4.1.1 Inherited & Synthesized Attributes 4.1.2 Evaluating an SDD at the nodes of a Parse Tree, Ex. 4.2 Evaluation Orders for SDD's 4.2.1 Dependency Graph 4.2.2 Ordering the Evaluation of Attributes 4.2.3 S-Attributed Definition 4.2.4 L-Attributed Definition 4.3 Application of SDT 4.3.1 Construction of syntax trees, 4.3.2 The Structure of a Type 4. 4 Translation Schemes 4.4.1 Definition, Postfix Translation Scheme	**8**
Unit – V	**5. Memory Allocation & Code Optimization** 5.1 Memory allocation – static and dynamic memory allocation, 5.2 Memory allocation in block structure languages, Array allocation and access. 5.3 Compilation of expression – 5.3.1 Concepts of operand descriptors and register descriptors with example. 5.3.2 Intermediate code for expressions – postfix notations, 5.3.3 triples and quadruples, expression trees. 5.4 Code Optimization – Optimizing transformations – compile time evaluation, elimination of common sub expressions, dead code elimination, frequency reduction, strength reduction 5.5 Three address code 5.5.1. DAG for Three address code 5.5.2 The Value-number method for constructing DAG's. 5.6 Definition of basic block, Basic blocks And flow graphs 5.7 Directed acyclic graph (DAG) representation of basic block 5.8 Issues in design of code generator	**10**

Unit –III	Syntax Analysis(Parser) Definition , Types of Parsers Top-Down Parser – Top-Down Parsing with Backtracking: Method &Problems Drawbacks of Top-Down parsing with backtracking,3.2.3Elimination of Left Recursion(direct & indirect) 3.2.4Need for Left Factoring & examples Recursive Descent Parsing : Definition 3.3.1Implementation of Recursive Descent Parser Using Recursive Procedures Predictive [LL(1)]Parser(Definition, Model) 3.4.1Implementation of Predictive Parser[LL(1)]	**20**

References :-

1. Compilers: Principles, Techniques, and Tools ,Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman
2. Principles of Compiler Design By : Alfred V. Aho, Jeffrey D. Ullman (Narosa Publication House)
3. LEX & YACC (O'reilly Publication)

Mapping of this course with Programme Outcomes & Justification

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

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

CO1:PO1: Strongly Related (3) - As compilers are fundamental tools in software development, aligning with the application of Computer Science principles.
CO2: PO1: Strongly Related (3) - As understanding compiler phases and design is a direct application of fundamental principles in Computer Science.
CO3:PO1: Strongly Related (3) - As designing lexical analyzers involves applying fundamental principles to analyze and process source code.
CO4:PO1: Strongly Related (3) - As constructing syntax analyzers requires applying principles to understand and represent the structure of code.
CO5:PO1: Strongly Related (3) - As generating intermediate code involves applying principles for optimizing and processing code.
CO6:PO1: Strongly Related (3) - As applying code optimization techniques directly relates to enhancing the efficiency of software applications.
CO7:PO1: Strongly Related (3) - As understanding the roles of compiler components aligns with applying fundamental principles to the compilation process in software development.

CO1:PO2: Strongly Related (3) - As designing and implementing solutions to computational problems often involves utilizing compiler knowledge in software development.
CO2:PO2: Strongly Related (3) - As designing a compiler requires the application of design principles, aligning with the objective of designing solutions to computational problems.
CO3:PO2: Strongly Related (3) - As designing lexical analyzers is a specific skill that contributes to the broader objective of designing computational solutions.
CO4:PO2: Strongly Related (3) - As constructing syntax analyzers is part of the process of designing and implementing solutions to computational problems.
CO5:PO2: Strongly Related (3) - As generating intermediate code is a step in the process of

implementing solutions to computational problems.
CO6:PO2: Strongly Related (3) - As applying optimization techniques is an essential aspect of designing efficient computational solutions.
CO7:PO2: Strongly Related (3) - As understanding compiler components contributes to the overall knowledge and skills needed for designing and implementing computational solutions.

CO1:PO3: Strongly Related (3) - As understanding compilers is a fundamental aspect of the discipline and contributes to imparting the basics.
CO2:PO3: Strongly Related (3) - As understanding the phases of a compiler is foundational knowledge in the discipline and contributes to imparting the basics.
CO3:PO3: Strongly Related (3) - As the ability to design lexical analyzers is a basic skill in the discipline, contributing to imparting the basics.
CO4:PO3: Strongly Related (3) - As constructing syntax analyzers is a fundamental skill in the discipline and contributes to imparting the basics.
CO5:PO3: Strongly Related (3) - As generating intermediate code is a basic aspect of the discipline and contributes to imparting the basics.
CO6:PO3: Strongly Related (3) - As applying code optimization techniques is a fundamental skill in thediscipline and contributes to imparting the basics.
CO7:PO3: Strongly Related (3) - As understanding compiler components is foundational in the disciplineand contributes to imparting the basics.

CO1:PO4: Moderately Related (2) - As understanding compilers contributes to foundational knowledge butmay not directly address broader professional development.
CO2:PO4: Moderately Related (2) - As knowledge of compiler phases is a specific skill that may be onecomponent of broader professional development.
CO3:PO4: Moderately Related (2) - As designing lexical analyzers is a specific skill that contributes totechnical expertise but may not cover the full spectrum of professional development.
CO4:PO4: Moderately Related (2) - As constructing syntax analyzers is a technical skill that contributes toproficiency but may not directly address broader professional development.
CO5:PO4: Moderately Related (2) - As generating intermediate code is a technical skill that adds to technicalproficiency but may not cover the entire scope of professional development.
CO6:PO4: Moderately Related (2) - As applying optimization techniques is a specific technical skill thatcontributes to professional development but is not the sole focus.
CO7:PO4: Moderately Related (2) - As understanding compiler components is a technical knowledge areathat contributes to professional development but may not cover all aspects of it.

CO1:PO5: Moderately Related (2) - As the understanding of compilers is a technical aspect, and its directconnection to societal and environmental impact may be indirect.
CO2:PO5: Moderately Related (2) - As the knowledge of compiler phases is essential for technicalproficiency, but its direct connection to societal and environmental impact may be indirect.
CO3:PO5: Partially Related (1) - As designing lexical analyzers is more focused on technical aspects andmay have limited direct relevance to societal and environmental contexts.
CO4:PO5: Partially Related (1) - As constructing syntax analyzers is a technical skill that may not directlyaddress societal and environmental impact.
CO5:PO5: Partially Related (1) - As generating intermediate code is a technical skill with limited directimpact on societal and environmental contexts.
CO6:PO5: Partially Related (1) - As code optimization techniques are technical skills that may not directlyaddress societal and environmental concerns.
CO7:PO5: Partially Related (1) - As understanding compiler components is more technical and may havelimited direct relevance to societal and environmental impact.

CO1:PO6: Strongly Related (3) - As understanding compilers is fundamental to developing proficiency incomputing.
CO2:PO6: Strongly Related (3) - As knowledge of compiler phases and design is essential for

proficiency incomputing.
CO3:PO6: Strongly Related (3) - As the ability to design lexical analyzers is a practical skill contributing toproficiency in computing.
CO4:PO6: Strongly Related (3) - As constructing syntax analyzers is a practical skill that enhancesproficiency in computing.
CO5:PO6: Strongly Related (3) - As generating intermediate code is a practical skill contributing toproficiency in computing.
CO6:PO6: Strongly Related (3) - As applying optimization techniques is a practical skill essential forproficiency in computing.
CO7:PO6: Strongly Related (3) - As understanding compiler components is practical knowledge contributingto proficiency in computing.

CO1:PO7: Strongly Related (3) - As understanding compilers is a foundational aspect for independent studyand research crucial for transitioning to employment.
CO2:PO7: Strongly Related (3) - As knowledge of compiler phases and design is essential for independentstudy and research, contributing to employment readiness.
CO3:PO7: Strongly Related (3) - As the ability to design lexical analyzers is a practical skill supportingindependent study and research for future employment.
CO4:PO7: Strongly Related (3) - As constructing syntax analyzers contributes to the capacity forindependent study and research, enhancing readiness for employment.
CO5:PO7: Strongly Related (3) - As generating intermediate code is a practical skill supporting independentresearch and contributing to employment readiness.
CO6:PO7: Strongly Related (3) - As applying optimization techniques is a practical skill crucial forindependent study and research, preparing for employment.
CO7:PO7: Strongly Related (3) - As understanding compiler components is foundational for independentstudy and research, contributing to employment readiness.

SYLLABUS (CBCS) FOR T.Y.B.Sc. (Computer Science) (SEM-VI)
Academic Year 2024-2025

Class: T.Y.B.Sc. (Computer Science) (Semester-VI) **Paper Code**: UCSCO363
Title of paper: Higher layer of Computer Network & Network Security **Paper:** III
Credit -3 **No. of Lectures**: 48

Pre-requisites: Basics of computer networks covered last semester.
Learning Objectives:

- To enable students to get sound understanding of additional Network concepts,
- Understand importance of network security and cryptography.
- To develop attitude and interest along with necessary knowledge and skills among the students to encourage them to do further academic studies / research in this area, after the completion of this Course.

Learning Outcomes: Learn the security concepts and techniques.
CO1: Addressing, Routing & Controlling - Understand addressing, configure, troubleshoot routing withalgorithms and protocols and traffic controlling.in network.
CO2: Network Transmission and Management – Understand, implement network transmission and know themonitoring tools with their troubleshoot and resolve network issues.
CO3: Internet Technologies - Understand the functions of upper layer technologies, implement andtroubleshoot internet services.
CO4: Network Security – Identify common network security issues, implement security measure, such asfirewalls and encryption to protect network.
CO5: Network Performance Optimization: Analyse and optimize network performance also implementQuality of services (QoS) mechanisms.
CO6: Multimedia base Communications - Understand digitizing, streaming stored and live audio and videocommunication with their protocols.
CO7: Ethical and Legal Considerations – Understand ethical considerations in network design and use.

Unit No	Title & Contents	No. of Lectures
I	**The Network Layer** 1.1 Design Issues Store-and-forward packet switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection Oriented Service, Comparison of Virtual Circuit and Datagram subnets 1.2 Logical Addressing IPV4 Addresses – Address Space, Notations,Classful Addressing, Subnetting, Supernetting, Classless Addressing, Network Address Translation(NAT), (Enough problems should be covered on Addressing), 1.3 IPV4 Protocol Datagram Format, Fragmentation, Checksum, Options. 1.4 Routing Properties of routing algorithm, Comparison of Adaptive and Non- Adaptive Routing Algorithms 1.5 Congestion Control – Definition, Factors of Congestion, Difference between congestion control and flow control, General Principles of Congestion Control, Congestion Prevention Policies 1.6 Network Layer Devices –Routers	10
II	**Address Mapping** Protocol(ARP)-Cache Memory, Packet Format, Encapsulation, Operation, Four Different Cases, Proxy ARP, RARP , BOOTP, DHCP – Static Address Allocation, Dynamic Address Allocation, Manual and automatic Configuration.	05
III	**The Transport Layer** 3.1 Process-to-Process Delivery Client Server Paradigm, Multiplexing and De-multiplexing, Connectionless Vs Connection-Oriented Service,	07

	Reliable Vs Unreliable 3.2 User Datagram Protocol(UDP) Datagram Format, Checksum, UDP operations, Use of UDP 3.3 Transmission Control Protocol (TCP) TCP Services – Process to-Process Communication, Stream Delivery Service, sending and Receiving Buffers, Segments, Full –Duplex Communication, Connection oriented service, Reliable service. 3.4 TCP Features –Numbering System, Byte Number, Sequence Number, Acknowledgement Number, Flow Control, Error Control, Congestion Control 3.5 TCP Segment – Format	
IV	**The Application Layer** 4.1 Domain Name System Name space-Flat name space, Hierarchical name space Domain Name Space -Label ,Domain name, FQDN, PQDN Distribution of Domain Name Space-Hierarchy of name servers, zone, Root server, Primary and secondary servers. DNS in the Internet: Generic domains, Country domains, inverse domain Resolution- Resolver, mapping names to address, mapping addresses to names, recursive resolution, iterative resolution, caching DNS messages-Header 4.2. Remote logging-Telnet: Time sharing Environment, Logging, NVT Character set, Embedding Options, mode of operation 4.3. Electronic Mail- Architecture-First scenario, second scenario, Third scenario, Fourth scenario User agent-services of user agent, types of UA Format of e-mail MIME-MIME header Message transfer agent-SMTP Message Access Agent: POP and IMAP 4.4. File Transfer - FTP-Communication over data control connection, File type, data structure, Transmission mode, anonymous FTP 4.5. WWW- Architecture, Client, Server, URL, Cookies 4.6. HTTP-HTTP transaction, messages 4.7 Devices – Gateways , Transport & Application gateways	10
V	**Multimedia** Digitizing Audio and Video ,Streaming stored Audio / Video , Streaming Live Audio / Video ,Real-Time Interactive Audio / Video RTP , RTCP	04

VI	**Cryptography and Network Security** 6.1 Introduction – Need of security, Security approaches, SecurityPrinciples, Types of attacks. 6.2. Cryptography concepts and Techniques - Plain text and cipher text, Encryption & Decryption, Categories of cryptography- Symmetric key,asymmetric key, comparison, Traditional ciphers Technique – substitution cipher, Transposition cipher. (problem should be covered) 6.3. Symmetric key cryptography- Algorithm types and modes (ECB,CBC,CFB,OFB) Symmetric key algorithm – DES, AES, IDEA 6.4. Asymmetric key cryptography- RSA 6.5. Security Services Message confidentiality-With Symmetric key cryptography, with asymmetric key cryptography Message integrity-Document and fingerprint, message and message digestMessage authentication-MAC, HMAC 6.6 Communication Security- Firewall, IP Security, Virtual Private Network (VPN). Wireless Security, Web Security.	12

Reference Books:

1) Computer Networks by Andrew Tanenbaum, Pearson Education.[Latest Edition]
2) Data Communication and Networking by Behrouz Forouzan, TATA McGraw Hill.[4th/5thEd.]
3) Networking All In One Dummies Wiley Publication.[5th Edition]
4) Cryptography and Network Security : Atul Kahate
5) Computer Network Security : Kizza, Springer
Network Security – Harrington, Elsevie

Mapping of this course with Programme Outcomes

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

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

relatedJustification of above mapping:

Mapping C01 with all POs:
C01- PO1: Understanding network addressing, routing, and traffic control involves the application ofmathematics, statistics, and computer fundamentals.
C01 - PO2: Configuring and troubleshooting routing and traffic control aligns with designing solutions forIT applications.
C01 - PO3: Implementing addressing, routing, and traffic control involves using modern engineering and ITtools.
CO1 – PO4:Understanding network protocols and control contributes to considering the impact of ITsolutions in societal and environmental contexts.
CO1 – PO5:Implementing network solutions involves applying ethical principles in IT solutiondevelopment.

CO1 – PO6: Understanding network protocols and control contributes to both individual work andcollaborative efforts within a team.
CO1 – PO7: Implementing addressing, routing, and traffic control aligns with innovation and employability.

Mapping C02 with all POs:
C02- PO1: Understanding network transmission involves applying knowledge of mathematics, statistics, andcomputer fundamentals.
C02 - PO2: Implementing network transmission aligns with designing solutions for IT applications.C02 - PO3: Implementing network transmission involves using modern engineering and IT tools.
CO2 – PO4:Resolving network issues contributes to considering the impact of IT solutions in societal andenvironmental contexts.
CO2 – PO5: Troubleshooting and resolving network issues involves applying ethical principles in IT solutiondevelopment.
CO2 – PO6: Resolving network issues contributes to both individual work and collaborative efforts within ateam.
CO2 – PO7: Implementing network transmission aligns with innovation and employability.

Mapping C03 with all POs:
C03- PO1: Understanding internet technologies involves applying knowledge of mathematics, statistics, andcomputer fundamentals.
C03 - PO2: Implementing internet technologies aligns with designing solutions for IT applications.C03 - PO3: Implementing internet technologies involves using modern engineering and IT tools.
CO3 – PO4:Troubleshooting internet services contributes to considering the impact of IT solutions insocietal and environmental contexts.
CO3 – PO5:Implementing and troubleshooting internet services involves applying ethical principles in ITsolution development.
CO3 – PO6:Troubleshooting internet services contributes to both individual work and collaborative effortswithin a team.
CO3 – PO7:Implementing internet technologies aligns with innovation and employability.

Mapping C04 with all POs:
C04- PO1: Identifying network security issues and implementing measures involves applying knowledge ofmathematics, statistics, and computer fundamentals.
C04 - PO2: Implementing network security aligns with designing solutions for IT applications.C04 - PO3: : Implementing network security involves using modern engineering and IT tools.
CO4 – PO4:Implementing network security contributes to considering the impact of IT solutions in societaland environmental contexts.
CO4 – PO5:Implementing network security involves applying ethical principles in IT solution development.CO4 – PO6Implementing network security contributes to both individual work and collaborative efforts within a team.
CO4 – PO7: Implementing network security aligns with innovation and employability.

Mapping C05 with all POs:
C05- PO1: Analysing and optimizing network performance involves applying knowledge of mathematics,statistics, and computer fundamentals.
C05 - PO2: Implementing network performance optimization aligns with designing solutions for ITapplications.
C05 - PO3Implementing network performance optimization involves using modern engineering and IT tools.CO5 – PO4:Optimizing network performance contributes to considering the impact of IT solutions in societal and environmental contexts.
CO5 – PO5:Implementing Quality of Services (QoS) mechanisms involves applying ethical principles in ITsolution development.

CO5 – PO6:Optimizing network performance contributes to both individual work and collaborative effortswithin a team.
CO5 – PO7:Implementing network performance optimization aligns with innovation and employability.

Mapping C06 with all POs:
C06- PO1: Understanding multimedia communications involves applying knowledge of mathematics,statistics, and computer fundamentals.
C06 - PO2: Understanding and implementing multimedia communication aligns with designing solutions forIT applications.
C06 - PO3: Implementing multimedia communication involves using modern engineering and IT tools.
CO6 – PO4:Understanding multimedia communication contributes to considering the impact of IT solutionsin societal and environmental contexts.
CO6 – PO5:Implementing multimedia communication involves applying ethical principles in IT solutiondevelopment.
CO6 – PO6:Understanding and implementing multimedia communication contributes to both individualwork and collaborative efforts within a team.
CO6 – PO7:Implementing multimedia communication aligns with innovation and employability.

Mapping C07 with all POs:
C07- PO1:Understanding ethical considerations in network design involves applying knowledge ofmathematics, statistics, and computer fundamentals.
C07 - PO2: Considering ethical considerations in network design aligns with designing solutions for ITapplications.
C07 - PO3: Considering ethical considerations in network design involves using modern engineering and ITtools.
CO7 – PO4: Understanding ethical considerations contributes to considering the impact of IT solutions insocietal and environmental contexts.
CO7 – PO5: Considering ethical considerations in network design involves applying ethical principles in ITsolution development.
CO7 – PO6: Understanding ethical considerations contributes to both individual work and collaborativeefforts within a team.
CO7 – PO7: Considering ethical considerations aligns with innovation and employability

SYLLABUS (CBCS) FOR T.Y.B.Sc. (Computer Science)
(Semester-VI)(w.e.f. from Academic Year 2024-2025)

Class :T.Y.B.Sc. (Computer Science) (Sem-VI) **Paper Code :** UCSCO364
Title of Paper: Advanced Web Development **Paper :** IV
Credits :03 (4 Lectures/Week) **No. oflectures :**48
Prerequisite : Know the Core PHP

Objectives :

- To learn the latest technologies used with PHP.
- To learn using JSON with PHP.
- To learn AJAX for applying dynamic changes to application.
- To learn package management.

Outcome :**Course Outcomes**:

CO1: On completion of the course, student will be able to build dynamic website
CO2: Create dynamic documents using XHTML and JavaScript.
CO3: Develop programs by XML which includes user defined tags
CO4: Construct PHP documents by using string, arrays, methods and also database access throughPHP.
CO5: Create applications using AJAX.
CO6: Develop web pages using HTML, DHTML and Cascading Styles Sheets
CO7: Develop dynamic web pages using JavaScript (client side programming)

Chapter No.	Chapter name with Topics	No. of LecturesRequired
1.	**Web Techniques** 1.1 Variables 1.2 Server information 1.3 Processing forms 1.4 Setting response headers 1.5 State management 1.6 JWT(JSON Web Tokens) 1.7 JWT Vs Sessions 1.8 SSL	**10**
2.	**JSON with PHP** 2.1 Introduction to JSON 2.2 JSON syntax 2.3 Datatypes in JSON 2.4 JSON Vs XML 2.5 Encoding JSON in PHP 2.6 Decoding JSON in PHP 2.7 Accessing the decoded values 2.8 Looping through the values	**08**
3.	**AJAX** 3.1 Introduction to AJAX 3.2 AJAX web application model 3.3 AJAX-PHP framework 3.4 Performing AJAX validation 3.5 Connecting database using php and AJAX	**10**

4.	**Intermediate JavaScript** 4.1 More Objects - Constructor Fuctions - Factory Functions - Constructor Method - new keyword 4.2 this	**14**
	- this in methods - window scope - this in functions declarations - this in events 4.3 Prototypes and ES6 Classes - Built-in constructor functions - Constructor property - Inheritance - this in classes 4.4 Asynchronous JS - Async / Await - Promises 4.5 Array Iteration Methods - forEach - Map - Filter - Reduce 4.6 String Manipulations - trim and split methods - toUpperCase and toLowerCase methods - includes method	
5.	**Collaborative Platform** 5.1 Package management 5.2 Frameworks like CodeIgniter, Symfony, Laravel - Installation - Features	**06**

References :

1. Kevin Tatroe, Peter MacIntyre (2020), Programming PHP : Creating DynamicWeb Pages(4th ed.). O'Reilly.

Web References :

1. https://www.php.net/manual/en/manual.php
2. https://www.php-fig.org/
3. https://phptherightway.com
4. https://w3schools.com

Mapping of this course with Program Outcomes

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	3	1	3	3
CO2	3	3	3	3	1	3	3
CO3	3	2	3	3	1	3	3
CO4	3	3	3	3	1	3	3
CO5	3	3	3	3	1	3	3
CO6	3	2	3	3	1	3	3
CO7	3	3	3	3	1	3	3

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

Justification of Mapping of PO1 to all COs

PO1: Apply fundamental principles and methods of Computer Science to a wide range of applications.
CO1: On completion of the course, students will be able to build a dynamic website.
Weight: 3 (Strongly related)
Justification: Building a dynamic website requires the application of fundamental principles and methods of Computer Science, involving various aspects such as programming, data management, and user interaction.
CO2: Create dynamic documents using XHTML and JavaScript.Weight: 3 (Strongly related)
Justification: Creating dynamic documents using XHTML and JavaScript involves applying principles of web development and programming, aligning closely with the fundamental principles of Computer Science.
CO3: Develop programs by XML which includes user-defined tags.Weight: 3 (Strongly related)
Justification: Developing programs using XML with user-defined tags requires a solid understanding of Computer Science principles, including data structures and data representation.
CO4: Construct PHP documents by using string, arrays, methods, and also database access through PHP.Weight: 3 (Strongly related)
Justification: Constructing PHP documents involving string manipulation, array handling, and database access demonstrates the application of core programming concepts within the field of web development.
CO5: Create applications using AJAX.Weight: 3 (Strongly related)
Justification: Creating applications using AJAX involves the utilization of asynchronous programming techniques, which is rooted in the principles of Computer Science, particularly in the domain of web development.
CO6: Develop web pages using HTML, DHTML, and Cascading Style Sheets.Weight: 3 (Strongly related)
Justification: Developing web pages using HTML, DHTML, and CSS requires an understanding of markup languages and style sheets, which are fundamental to web development and, by extension, Computer Science.
CO7: Develop dynamic web pages using JavaScript (client-side programming).Weight: 3 (Strongly related)

Justification of Mapping of PO2 to all Cos

PO2: Design, correctly implement and document solutions to significant computational problems.
CO1: On completion of the course, students will be able to build a dynamic website.
Weight: 3 (Strongly related)
Justification: Building a dynamic website involves designing, implementing, and documenting solutions tocomputational problems, aligning strongly with the goal of PO2.
CO2: Create dynamic documents using XHTML and JavaScript.Weight: 3 (Strongly related)
Justification: Creating dynamic documents with XHTML and JavaScript requires designing and implementing solutions, demonstrating a strong connection to the goal of PO2.

CO3: Develop programs by XML which includes user-defined tags.Weight: 2 (Moderately related)
Justification: While developing programs using XML involves computational problem-solving, the directlink to designing and implementing significant solutions is moderate compared to other outcomes.
CO4: Construct PHP documents by using string, arrays, methods, and also database access through PHP.Weight: 3 (Strongly related)
Justification: Constructing PHP documents involves designing and implementing solutions to computationalproblems, particularly in the context of web development, aligning strongly with the goal of PO2.
CO5: Create applications using AJAX.Weight: 3 (Strongly related)
Justification: Creating applications with AJAX involves solving computational problems related to asynchronous communication, showcasing a strong connection to the goal of PO2.
CO6: Develop web pages using HTML, DHTML, and Cascading Style Sheets.Weight: 2 (Moderately related)
Justification: Developing web pages with HTML, DHTML, and CSS involves computational problem-solving, but the direct link to designing and implementing significant solutions is moderate compared to other outcomes.
CO7: Develop dynamic web pages using JavaScript (client-side programming).Weight: 3 (Strongly related)

Justification of Mapping of PO3 to all Cos

CO1: Strongly related (Weight: 3) - Imparting an understanding of the basics of web development, as per PO3, is fundamental to the ability to develop dynamic and interactive web pages, which is the specific goal of CO1.
CO2: Strongly related (Weight: 3) - Understanding the basics of web development, as covered in PO3, is essential for evaluating common errors in web languages and repairing them to meet standards, aligning directly with CO2.
CO3: Strongly related (Weight: 3) - PO3 focuses on distinguishing between personalized and dynamic web pages, which is directly relevant to understanding how servers and web languages can be used for different website needs, as stated in CO3.
CO4: Strongly related (Weight: 3) - The distinction between objective and subjective analysis, covered in PO3, is crucial for conducting both analyses for website designs, as specified in CO4.
CO5: Strongly related (Weight: 3) - The understanding of personalized and dynamic web pages, emphasizedin PO3, is directly connected to the ability to distinguish how servers and web languages can be used fordifferent website needs, aligning with CO5.
CO6: Strongly related (Weight: 3) - PO3's focus on distinguishing between objective and subjective analysisdirectly supports the goal of CO6, which is to distinguish between these two types of analyses.
CO7: Strongly related (Weight: 3) - Designing and producing a completed website for a specified client, as per CO7, requires a comprehensive understanding of the basics of web development, which is the main goal of PO3.In summary, PO3 is strongly related to all the specified course outcomes (CO1 to CO7) because it provides the foundational knowledge and understanding necessary to achieve these outcomes.

Justification of Mapping of PO4 to all COs

PO4 is strongly related to CO1, CO2, CO3, CO4, CO5, CO6, and CO7, with the following justifications:CO1: Strongly related (Weight: 3) - Preparing for continued professional development, as stated in PO4,involves understanding how to develop dynamic and interactive web pages, aligning directly with the
goal of CO1.
CO2: Strongly related (Weight: 3) - Continued professional development requires the ability to evaluate common errors in web languages and repair them to meet standards, which is in line with the skills emphasized in CO2.
CO3: Strongly related (Weight: 3) - Distinguishing between personalized and dynamic web pages and understanding how servers and web languages can be used for different website needs, as covered in PO4, contributes to the professional development of a web developer, aligning with CO3.
CO4: Strongly related (Weight: 3) - Continued professional development involves the ability to distinguish between objective and subjective analysis, as emphasized in PO4, which aligns directly with the goal of CO4.

CO5: Strongly related (Weight: 3) - Understanding the distinctions between personalized and dynamic web pages and how servers and web languages can be used for different website needs, as per PO4, contributes to the professional development of a web developer, aligning with CO5.
CO6: Strongly related (Weight: 3) - Continued professional development requires the ability to distinguish between objective and subjective analysis, as emphasized in PO4, which aligns directly with the goal of CO6.
CO7: Strongly related (Weight: 3) - Designing and producing a completed website for a specified client, as per CO7, is a practical application that contributes to the professional development of a web developer, aligning with PO4.

Justification of Mapping of PO5 to all COs
PO5 is partially related to the listed course outcomes (CO1 to CO7), with varying degrees of relevance:
CO1: Partially related (Weight: 1) - Understanding the impact of IT analyst solutions in societal and environmental contexts and demonstrating knowledge for sustainable development (PO5) is not explicitly addressed by the ability to develop dynamic and interactive web pages (CO1). The focus of CO1 is on technical skills rather than the broader impact of IT solutions.
CO2: Partially related (Weight: 1) - While evaluating common errors and repairing them to meet standards (CO2) is a technical aspect, it doesn't directly address the societal and environmental impact or sustainable development, which are the key components of PO5.
CO3: Partially related (Weight: 1) - Distinguishing between personalized and dynamic web pages and understanding how servers and web languages can be used for different website needs (CO3) is more focused on technical aspects of web development and doesn't explicitly address the societal or environmental context emphasized in PO5.
CO4: Partially related (Weight: 1) - Distinguishing between objective and subjective analysis and conducting both analyses for website designs (CO4) is primarily a skill related to website design and analysis, and it does not explicitly tie to the broader societal or environmental context emphasized in PO5.
CO5: Partially related (Weight: 1) - The distinction between personalized and dynamic web pages and how servers and web languages can be used for different website needs (CO5) is more of a technical skill anddoes not directly address the societal or environmental impact or sustainable development emphasized inPO5.
CO6: Partially related (Weight: 1) - Distinguishing between objective and subjective analysis (CO6) is a skill related to website analysis and design but does not explicitly address the broader societal or environmental context emphasized in PO5.
CO7: Partially related (Weight: 1) - Designing and producing a completed website for a specified client (CO7) is a practical skill in web development, and it does not explicitly address the societal or environmental impact or sustainable development emphasized in PO5.

Justification of Mapping of PO6 to all COs
CO1: Strongly related (Weight: 3) - Developing proficiency in the practice of computing (PO6) is directly aligned with the ability to understand how to develop dynamic and interactive web pages (CO1). Proficiency in computing encompasses the skills needed for web development.
CO2: Strongly related (Weight: 3) - Developing proficiency in the practice of computing involves evaluating common errors in web languages and repairing them to meet standards (CO2). Proficiency in web development includes the ability to address and correct errors.
CO3: Strongly related (Weight: 3) - Proficiency in computing requires a deep understanding of personalizedand dynamic web pages and how servers and web languages can be used for different website needs (CO3). These skills are integral to the practice of computing in web development.
CO4: Strongly related (Weight: 3) - Distinguishing between objective and subjective analysis and conducting both analyses for website designs (CO4) is part of developing proficiency in computing, particularly in the realm of web development and analysis.
CO5: Strongly related (Weight: 3) - Proficiency in computing involves the ability to distinguish between personalized and dynamic web pages and understand how servers and web languages can be used for different website needs (CO5). These skills contribute to overall proficiency in web development.
CO6: Strongly related (Weight: 3) - Distinguishing between objective and subjective analysis (CO6) is a crucial aspect of developing proficiency in computing, particularly in the context of web

development and design.
CO7: Strongly related (Weight: 3) - Designing and producing a completed website for a specified client (CO7) is a practical application of the proficiency in computing developed throughout the course. It represents the culmination of the skills and knowledge acquired.
In summary, PO6 is strongly related to all specified course outcomes (CO1 to CO7) as it encapsulates the overarching goal of developing proficiency in the practice of computing, with a specific emphasis on web development skills.

Justification of Mapping of PO7 to all Cos

CO1: Strongly related (Weight: 3) - Developing the capacity to study and research independently (PO7) aligns with the goal of understanding how to develop dynamic and interactive web pages (CO1). Independent study and research are integral to mastering web development.
CO2: Strongly related (Weight: 3) - The capacity to study and research independently (PO7) is crucial for evaluating common errors in web languages and repairing them to meet standards (CO2). Independent research enhances problem-solving skills in addressing errors.
CO3: Strongly related (Weight: 3) - Developing skills for independent study and research (PO7) is directly related to distinguishing between personalized and dynamic web pages and understanding how servers and web languages can be used for different website needs (CO3).
CO4: Strongly related (Weight: 3) - The capacity to study and research independently (PO7) is essential for distinguishing between objective and subjective analysis and conducting both analyses for website designs (CO4). Independent research supports a comprehensive understanding of analysis techniques.
CO5: Strongly related (Weight: 3) - The ability to study and research independently (PO7) contributes to distinguishing between personalized and dynamic web pages and understanding how servers and web languages can be used for different website needs (CO5). Independent research enhances knowledge in this area.
CO6: Strongly related (Weight: 3) - Developing the capacity for independent study and research (PO7) is directly related to distinguishing between objective and subjective analysis (CO6). Independent researchsupports a deeper understanding of analytical approaches.
CO7: Strongly related (Weight: 3) - The capacity to study and research independently (PO7) is crucial for designing and producing a completed website for a specified client (CO7). Independent research contributes to the development of practical skills in web development.
In summary, PO7 is strongly related to all the specified course outcomes (CO1 to CO7) as it emphasizes the development of skills for independent study and research, which is essential for mastering the various aspects of web development covered in the course.

SYLLABUS (CBCS) FOR T.Y.B. Sc. (Computer Science) (Semester- VI)
(w.e.f from Academic Year 2024-2025)

Class: T.Y.B.Sc. (Computer Science) (Sem-VI) **Paper Code: U**CSCO365
Title of Paper: Advanced Java Technologies – Frameworks **Paper:** V
Credit: 3 (4 Lectures/Week) **No. of lectures:** 48

Aim: To understand the design and implementation of Java Frameworks.

Objectives: To understand Hibernate, Spring Core, Spring MVC, and Spring Boot to develop EnterpriseApplications

Learning Outcome:

CO1: Mastery of Hibernate Framework
CO2: Comprehensive Knowledge of Spring Framework
CO3: Advanced Spring Core Skills
CO4: Building Web Applications with Spring MVC
CO5: Efficient Development with Spring Boot
CO6: Integration of Hibernate with Spring
CO7: Building Micro-services with Spring Cloud

Unit No.	Chapter name with Topics	No. of Lectures Required
1.	Hibernate ORM Overview Hibernate Overview Architecture Hibernate Configuration Hibernate Sessions Persistent Class O/R Mapping One-to-One Mappings One-to-Many Mappings Many-to-Many Mappings Hibernate using Annotation Hibernate Query Language (HQL) SQL Dialects in Hibernate Transaction Management	**14**
2.	Spring Core Introduction and Overview Applications of Spring Advantages of Spring Framework Dependency Injection (DI) Inversion of Control (IoC) Aspect Oriented Programming (AOP) Architecture / Modules Difference between constructor and setter injection Autowiring in Spring Bean Definition Bean Scopes Bean Life Cycle	**13**
3.	Spring MVC Introduction and Overview	**9**

	Multiple View page Multiple Controller Model Interface RequestParam Annotation Form Tag Library	
4.	Spring Boot Introduction and OverviewSpring Boot Versions Spring vs. Spring Boot vs. Spring MVCSpring Boot Architecture Spring Initializr Download and Install STS IDECreating a Spring Boot Project Creating a Spring Boot Project Using STSSpring Boot Annotations Spring Boot Dependency ManagementSpring Boot Application Properties	**12**

Reference:

1. https://spring.io/
2. https://hibernate.org/

Mapping of this course with Program Outcomes

Course Outcomes	Program Outcomes						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	3	3	3	1	1	2	2
CO2	3	3	3	1	1	2	2
CO3	3	3	3	1	1	2	2
CO4	3	3	3	1	1	2	2
CO5	3	3	3	1	1	2	2
CO6	3	3	3	1	2	2	2
CO7	3	3	3	1	2	3	3

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

PO1 with All COs

CO1: PO1:3 (Strongly related): as computer system simulation involves applying mathematical andcomputational fundamentals to understand and model IT systems.

CO2: PO1: 3 (Strongly related): as implementing assembly programs requires a deep understanding of computerfundamentals and mathematics.

CO3: PO1: 3 (Strongly related): as working with shell commands and system calls requires knowledge ofcomputer fundamentals and IT applications.

CO4:PO1: 3(Strongly related): as CPU scheduling algorithms involve applying mathematical and computationalprinciples to optimize system performance.

CO5: PO1: 3 (Strongly related): as shell scripting and command-line interfaces are integral parts of ITapplications, requiring computer knowledge.

CO6: PO1: 3 (Strongly related): as implementing the Banker's algorithm involves applying mathematical andcomputational concepts to address system deadlock issues.

CO7: PO1: 3 (Strongly related): as troubleshooting in these areas requires applying computer

knowledge andproblem-solving skills.

PO2 with All COs

CO1: PO2: 3 (Strongly related): as understanding computer system simulation is foundational to designing anddeveloping solutions in various IT contexts.
CO2: PO2: 3 (Strongly related): as the ability to implement assembly programs is a key aspect of designing anddeveloping solutions at a low level.
CO3: PO2: 3 (Strongly related): as familiarity with shell commands and system calls is essential for designing anddeveloping solutions involving command-line interfaces.
CO4: PO2: 3 (Strongly related): as knowledge of CPU scheduling algorithms is crucial for designing efficient andoptimized system solutions.
CO5: PO2: 3(Strongly related): as proficiency in shell scripting and command-line interfaces is valuable indesigning and developing practical solutions.
CO6: PO2: 3 (Strongly related): as implementing the Banker's algorithm is a specific design solution fordeadlock avoidance in system development.
CO7: PO2: 3 (Strongly related): as troubleshooting skills are essential for the ongoing development andmaintenance of solutions.

PO3 with All COs

CO1: PO3: 3 (Strongly related): as simulation tools are modern tools extensively used for understanding andmodeling complex computer systems.
CO2: PO3: 3(Strongly related) as modern tools for assembly programming are essential for efficient and error-free implementation.
CO3: PO3: 3 (Strongly related): as proficiency in using modern command-line tools is crucial for effectiveutilization of shell commands and system calls.
CO4: PO3: 3(Strongly related): as modern tools are employed to simulate and analyze the performance of variousCPU scheduling algorithms.
CO5: PO3: 3 (Strongly related): as modern tools and editors are commonly used for efficient development andexecution of shell scripts.
CO6: PO3: 3 (Strongly related): as the implementation and simulation of algorithms often involve the use ofmodern programming tools and environments.
CO7: PO3: 3 (Strongly related): as modern debugging and profiling tools are essential for effectivetroubleshooting in various areas of system development.

PO4 with All COs

CO1: PO4: 1(Partially related): as computer system simulation, is more aligned with technical aspects than directenvironmental and sustainability considerations.
CO2: PO4: 1(Partially related):as assembly programming focuses on technical skills rather than directimplications for environmental and sustainability concerns.
CO3: PO4: 1(Partially related): as shell commands and system calls are more technical in nature and have limiteddirect connection to environmental and sustainability aspects.
CO4: PO4: 1 (Partially related): as CPU scheduling algorithms are primarily technical and do not have a strongdirect link to environmental and sustainability considerations.
CO5: PO4: 1 (Partially related): as shell scripting and command-line interfaces are technical skills with limiteddirect impact on environmental and sustainability aspects.
CO6:PO4: 1(Partially related): as the Banker's algorithm focuses on technical aspects of deadlock avoidancerather than environmental or sustainability implications.
CO7: PO4: 1 (Partially related): as troubleshooting skills are more aligned with technical problem-solving andhave limited direct connection to environmental and sustainability concerns.

PO5 with All COs

CO1: PO5: 1 (Partially related): as computer system simulation is more aligned with technical aspects, and itsconnection to ethical principles is indirect.

CO2:PO5: 1(Partially related): as assembly programming primarily focuses on technical skills rather than directethical considerations.

CO3: PO5: 1 (Partially related): as shell commands and system calls are technical in nature and have limiteddirect connection to ethical principles.

CO4: PO5: 1 (Partially related): as CPU scheduling algorithms are primarily technical and do not have a strongdirect link to ethical considerations.

CO5: PO5: 1(Partially related): as shell scripting and command-line interfaces are technical skills with limiteddirect impact on ethical principles.

CO6: PO5: 2 (Moderately related): as the implementation of the Banker's algorithm may involve considerationsrelated to ethical and responsible programming practices.

CO7: PO5: 2 (Moderately related) as troubleshooting involves ethical considerations, such as maintaining theintegrity and security of systems.

PO6 with All COs

CO1: PO6: 2(Moderately related): as collaborative efforts may be involved in designing and interpretingsimulations.

CO2: PO6: 2 (Moderately related): as teamwork may be required for collaborative coding, code reviews, ortroubleshooting.

CO3: PO6: 2 (Moderately related): as working on command-line interfaces and scripting may involvecollaboration and knowledge sharing within a team.

CO4: PO6: 2 (Moderately related): as understanding and implementing scheduling algorithms may requireteamwork for analysis and optimization.

CO5: PO6: 2 (Moderately related): as collaboration and sharing of scripts within a team may be necessary foreffective system management.

CO6: PO6: 2(Moderately related): as collaborative efforts may be needed to implement and test the Banker'salgorithm in a simulated environment.

CO7: PO6: 3(Strongly related): as troubleshooting often involves collaboration and collective problem-solvingwithin a team.

PO7 with All COs

CO1: PO7: 2 (Moderately related): as simulation skills may contribute to innovative problem-solving andemployability in technical roles.

CO2: PO7: 2 (Moderately related): as assembly programming skills may enhance employability in technical fieldsand contribute to innovative solutions.

CO3: PO7: 2 (Moderately related): as proficiency in shell commands and system calls is valuable foremployability and innovation in system administration and development.

CO4: PO7: 2 (Moderately related):as knowledge of CPU scheduling algorithms can contribute to innovativesolutions and employability in system optimization roles.

CO5:PO7: 2 (Moderately related): as scripting skills are often sought after in IT roles, contributing toemployability and potential innovation in automation.

CO6: PO7: 2 (Moderately related): as implementation of algorithms demonstrates technical competence relevantto employability and innovation.

CO7: PO7: 3 (Strongly related): as troubleshooting skills are critical for employability and can contribute toinnovation by solving complex technical challenges.

SYLLABUS (CBCS) FOR T.Y.B. Sc. (Computer Science) (Semester- VI)
(w.e.f from Academic Year 2024-2025)

Class: T.Y.B.Sc. (Computer Science) (Sem-VI) **Paper Code: U**CSCO366
Title of Paper: Software Metrics and Project Management **Paper:** VI
Credit: 3 (4 Lectures/Week) **No. of lectures:** 48

Prerequisites : Knowledge of Software Engineering

Aim : To Understand Software metrics and project management and their applicability.
Objectives:

1. To know of how to do project planning for the software process.
2. To learn the cost estimation techniques during the analysis of the project.
3. To understand the quality concepts for ensuring the functionality of the software

Course Outcomes.

CO1: Able to create reliable, replicable cost estimation that links to the requirements of projectplanning and managing.
CO2 : Students should be able to design and construct a hardware and software system,component, or process to meet desired needs.
CO3 : Students are provided to work on multidisciplinary Problems. Students should be able towork as professionals, with portfolio ranging from data management, network configuration, designing hardware, database and software design to management and administration of entire systems.
CO4 : To understand the fundamental principles of software project management.
CO5 : To have a good knowledge of responsibilities of project manager.
CO6 : To be familiar with the different methods and techniques used for projectmanagement
CO7 : Prescribe the conventional and evolution of software.

Title and Contents		No. of Lectures
UNIT 1	**SOFTWARE PROJECT MANAGEMENT CONCEPTS** 1.1 Introduction to Software Project Management: Project phase and project life Cycle, Organizational structure. 1.2 An Overview of Project Planning: Select, Identifying Project scope and objectives, infrastructure, project products and Characteristics. Estimate efforts, Identify activity risks, and allocate resources- TQM, Six Sigma 1.3 Software Quality: defining software quality, ISO9126, External Standards. 1.4 Project Plan development and Execution, Change control, Configuration Management,Activity Planning, Schedule Development and Control	**08**

UNIT 2	**OVERVIEW OF PROJECT MANAGEMENT COMPONENTS** 2.1 Project Integration Management 2.2 Project Scope Management 2.3 Project Time Management 2.4 Project Cost Management 2.5 Project Quality Management 2.6 Project Human Resource Management 2.6 Project Communications Management 2.7 Project Risk Management 2.8 Project Procurement Management 2.9 Project Stakeholder Management	**10**
UNIT 3	**SOFTWARE EVALUATION AND COSTING** 3.1 Project Evaluation: Strategic Assessment, Technical Assessment, cost-benefit analysis, flow forecasting, cost-benefit evaluation techniques,Risk Evaluation. 3.2 Selection of Appropriate Project approach: Choosing technologies, choice of process models, structured methods.	**04**
UNIT 4	**SOFTWARE ESTIMATION TECHNIQUES** 4.1 Software Effort Estimation: Problems withOverand under estimations, Basis of softwareEstimation, Software estimation techniques, expert Judgment, Estimating by analogy. 4.2 Activity Planning: Project schedules, projects and activities, sequencing and scheduling Activities,networks planning models, Formulating a network model	**10**
UNIT 5	**RISK MANAGEMENT** 5.1 Risk Management: Nature of Risk, Managing Risk, Risk Identification and Analysis, Reducing the Risk. 5.2 Resource Allocation: Scheduling resources, Critical Paths, Cost scheduling, 5.3 Monitoring and Control: Creating Framework, cost monitoring, prioritizing monitoring.	**06**
UNIT 6	**INTRODUCTION TO SOFTWARE PROJECT METRICS** 6.1 Introduction to Software Project Metrics, Types Of Software Project Metrics, Scope of Software Project Metrics ,Software metrics and Data collection, 6.2 Metrics Measurement: Measurement and prediction, Resource measurement, Productivity Measurement, Mapping measurement activities, Measurement tool, Role of Measures (Analyst, tools, Plans, Revision Plans, 6.3 Quality Measurement- Quality Standards (ISO,MC-Call, CMM, PSP/TSP) 6.4 Globalization issues in project management (Evaluation, Advantages, Dis-advantages) 6.5 Impact of the internet on project management (effect on management activities) 6.6 CASE Studies Software project Management	**10**

REFERENCES:

1. Bob Hughes & Mike Cotterell, "Software Project Management", Tata McGraw-HillPublications, Fifth Edition 2012
2. Futrell , "Quality Software Project Management", Pearson Education India, 2008
3. Gobalswamy Ramesh, "Managing Global Software Projects", Tata McGraw HillPublishing Company, 2003
4. Richard H.Thayer "Software Engineering Project Management", IEEE ComputerSociety
5. S. A. Kelkar," Software Project Management" PHI, New Delhi, Third Edition ,2013

6. Roger Pressman “ISE Software Engineering: A Practitioner's Approach” ISE HED IRWINCOMPUTER SCIENCE 9th Edition 2019
7. Kathy Schwalbe “Information Technology Project Management”Cengage Learning Canada Inc.9th Edition
8. Norman Feton, Shari Lawrence pfleeger : Software Metrics : A rigorous and PracticalApproch”PWS Publishing Company, 1997 2nd Edition
9. http://en.wikipedia.org/wiki/Comparison_of_project_management_softwar
10. http://www.ogc.gov.uk/methods_prince_2.asp

Mapping of this course with Programme Outcomes

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	1	1	2	1	2	2
CO2	3	3	2	3	2	3	3
CO3	3	2	3	3	3	2	2
CO4	2	1	2	2	1	2	1
CO5	2	1	2	2	1	1	1
CO6	2	1	2	2	1	2	1
CO7	2	1	1	1	1	1	1

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

CO1: Able to create reliable, replicable cost estimation that links to the requirements of project planning and managing.
PO1: Apply fundamental principles and methods of Computer Science to a wide range of applications.(Weightage: 2)
CO2: Students should be able to design and construct a hardware and software system, component, or process to meet desired needs.
PO1:Apply fundamental principles and methods of Computer Science to a wide range of applications.(Weightage: 3)
CO3: Students are provided to work on multidisciplinary Problems. Students should be able to work as professionals, with a portfolio ranging from data management, network configuration, designing hardware, database and software design to the management and administration of entire systems.
PO1:Apply fundamental principles and methods of Computer Science to a wide range of applications. (Weightage: 3)
CO4:To understand the fundamental principles of software project management.
PO1:Apply fundamental principles and methods of Computer Science to a wide range of applications. (Weightage: 2)
CO5:To have a good knowledge of responsibilities of the project manager.
PO1:Apply fundamental principles and methods of Computer Science to a wide range of applications.(Weightage: 2)
CO6:To be familiar with the different methods and techniques used for project management.
PO1:Apply fundamental principles and methods of Computer Science to a wide range of applications.(Weightage: 2)
CO7:Prescribe the conventional and evolution of software.
PO1:Apply fundamental principles and methods of Computer Science to a wide range of applications.(Weightage: 2)
This mapping is based on the given weightage, where a higher weightage indicates a stronger relationship between the course outcome and program outcome. Keep in mind that the interpretation of the weightage may vary based on the specific context and goals of the educational program.

CO1: Able to create reliable, replicable cost estimation that links to the requirements of project planning and managing
PO2: Design, correctly implement, and document solutions to significant computational problems. (Weightage: 1)
CO2: Students should be able to design and construct a hardware and software system, component, or

process to meet desired needs.
PO2: Design, correctly implement, and document solutions to significant computational problems. (Weightage: 3)
CO3: Students are provided to work on multidisciplinary Problems. Students should be able to work as professionals, with a portfolio ranging from data management, network configuration, designing hardware, database and software design to the management and administration of entire systems.
PO2: Design, correctly implement, and document solutions to significant computational problems. (Weightage: 2)
CO4: To understand the fundamental principles of software project management.
PO2: Design, correctly implement, and document solutions to significant computational problems. (Weightage: 1)
CO5: To have a good knowledge of responsibilities of the project manager.
PO2: Design, correctly implement, and document solutions to significant computational problems. (Weightage: 1)
CO6: To be familiar with the different methods and techniques used for project management. PO2: Design, correctly implement, and document solutions to significant computational problems. (Weightage: 1)
CO7: Prescribe the conventional and evolution of software.
PO2: Design, correctly implement, and document solutions to significant computational problems. (Weightage: 1)

CO1: Able to create reliable, replicable cost estimation that links to the requirements of project planning and managing.
PO3:Impart an understanding of the basics of our discipline. (Weightage: 1)
CO2: Students should be able to design and construct a hardware and software system, component, or process to meet desired needs.
PO3: Impart an understanding of the basics of our discipline. (Weightage: 2)
CO3: Students are provided to work on multidisciplinary Problems. Students should be able to work as professionals, with a portfolio ranging from data management, network configuration, designing hardware, database and software design to management and administration of entire systems.
PO3:Impart an understanding of the basics of our discipline**.** (Weightage: 3)
CO4: To understand the fundamental principles of software project management.
PO3:Impart an understanding of the basics of our discipline. (Weightage: 2)
CO5: To have a good knowledge of responsibilities of the project manager.
PO3:Impart an understanding of the basics of our discipline. (Weightage: 2)
CO6: To be familiar with the different methods and techniques used for project management.
PO3:Impart an understanding of the basics of our discipline. (Weightage: 2)
CO7: Prescribe the conventional and evolution of software.
PO3:Impart an understanding of the basics of our discipline. (Weightage: 1)

CO1: Able to create reliable, replicable cost estimation that links to the requirements of project planning and managing.
PO6:Develop proficiency in the practice of computing. (Weightage: 2)
CO2: Students should be able to design and construct a hardware and software system, component, or process to meet desired needs.
PO6:Develop proficiency in the practice of computing. (Weightage: 3)
CO3: Students are provided to work on multidisciplinary Problems. Students should be able to work as professionals, with a portfolio ranging from data management, network configuration, designing hardware, database and software design to the management and administration of entire systems.
PO6:Develop proficiency in the practice of computing. (Weightage: 2)
CO4:To understand the fundamental principles of software project anagement.
PO6:Develop proficiency in the practice of computing. (Weightage: 2)
CO5:To have a good knowledge of responsibilities of the project manager.
PO6:Develop proficiency in the practice of computing. (Weightage: 1)
CO6:To be familiar with the different methods and techniques used for project management.
PO6:Develop proficiency in the practice of computing. (Weightage: 2)

CO7:Prescribe the conventional and evolution of software.
PO6:Develop proficiency in the practice of computing. (Weightage: 1)

CO1: Able to create reliable, replicable cost estimation that links to the requirements of project planning and managing.
PO4:Prepare for continued professional development. (Weightage: 2)
CO2: Students should be able to design and construct a hardware and software system, component, or process to meet desired needs.
PO4:Prepare for continued professional development. (Weightage: 3)
CO3:Students are provided to work on multidisciplinary Problems. Students should be able to work as professionals, with a portfolio ranging from data management, network configuration, designing hardware, database and software design to the management and administration of entire systems.
PO4: Prepare for continued professional development. (Weightage: 3)
CO4:To understand the fundamental principles of software project management.
PO4:Prepare for continued professional development. (Weightage: 2)
CO5: To have a good knowledge of responsibilities of the project manager.
PO4:Prepare for continued professional development. (Weightage: 2)
CO6:To be familiar with the different methods and techniques used for project management.
PO4:Prepare for continued professional development. (Weightage: 2)
CO7:Prescribe the conventional and evolution of software.
PO4:Prepare for continued professional development. (Weightage: 1)

CO1: Able to create reliable, replicable cost estimation that links to the requirements of project planning and managing.
PO5:Understand the impact of the IT analyst solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development. (Weightage: 1)
CO2: Students should be able to design and construct a hardware and software system, component, or process to meet desired needs.
PO5:Understand the impact of the IT analyst solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development. (Weightage: 2)
CO3: Students are provided to work on multidisciplinary Problems. Students should be able to work as professionals, with a portfolio ranging from data management, network configuration, designing hardware, database and software design to the management and administration of entire systems.
PO5:Understand the impact of the IT analyst solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development. (Weightage: 3)
CO4:To understand the fundamental principles of software project management.
PO5:Understand the impact of the IT analyst solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development. (Weightage: 2)
CO5:To have a good knowledge of responsibilities of the project manager.
PO5:Understand the impact of the IT analyst solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development. (Weightage: 1)
CO6:To be familiar with the different methods and techniques used for project management.
PO5:Understand the impact of the IT analyst solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development. (Weightage: 1)
CO7: Prescribe the conventional and evolution of software.
PO5:Understand the impact of the IT analyst solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development. (Weightage: 1)

CO1: Able to create reliable, replicable cost estimation that links to the requirements of project planning and managing.
PO6:Develop proficiency in the practice of computing. (Weightage: 2)
CO2: Students should be able to design and construct a hardware and software system, component, or process to meet desired needs.
PO6:Develop proficiency in the practice of computing. (Weightage: 3)
CO3: Students are provided to work on multidisciplinary Problems. Students should be able to work as professionals, with a portfolio ranging from data management, network configuration, designing

hardware, database and software design to the management and administration of entire systems.
PO6: Develop proficiency in the practice of computing. (Weightage: 2)
CO4:To understand the fundamental principles of software project management.
PO6:Develop proficiency in the practice of computing. (Weightage: 2)
CO5:To have a good knowledge of responsibilities of the project manager.
PO6:Develop proficiency in the practice of computing. (Weightage: 1)
CO6:To be familiar with the different methods and techniques used for project management.
PO6:Develop proficiency in the practice of computing. (Weightage: 2)
CO7:Prescribe the conventional and evolution of software.
PO6:Develop proficiency in the practice of computing. (Weightage: 1)

CO1: Able to create reliable, replicable cost estimation that links to the requirements of project planning and managing.
PO7:Develop the capacity to study and research independently that will help to develop skills for transition to employment in hardware/software companies. (Weightage: 2)
CO2: Students should be able to design and construct a hardware and software system, component, or process to meet desired needs.
PO7:Develop the capacity to study and research independently that will help to develop skills for transition to employment in hardware/software companies. (Weightage: 3)
CO3: Students are provided to work on multidisciplinary Problems. Students should be able to work as professionals, with a portfolio ranging from data management, network configuration, designing hardware, database and software design to the management and administration of entire systems.
PO7: Develop the capacity to study and research independently that will help to develop skills for transition to employment in hardware/software companies. (Weightage: 2)
CO4: To understand the fundamental principles of software project management.
PO7: Develop the capacity to study and research independently that will help to develop skills for transition to employment in hardware/software companies. (Weightage: 1)
CO5:To have a good knowledge of responsibilities of the project manager.
PO7:Develop the capacity to study and research independently that will help to develop skills for transition to employment in hardware/software companies. (Weightage: 1)
CO6:To be familiar with the different methods and techniques used for project management.
PO7:Develop the capacity to study and research independently that will help to develop skills for transition to employment in hardware/software companies. (Weightage: 1)
CO7: Prescribe the conventional and evolution of software.
PO7:Develop the capacity to study and research independently that will help to develop skills for transition to employment in hardware/software companies. (Weightage: 1)
This mapping is based on the given weightage, where a higher weightage indicates a stronger relationship between the course outcome and program outcome. Keep in mind that the interpretation of the weightage may vary based on the specific context and goals of the educational program.

SYLLABUS (CBCS) FOR T.Y.B. Sc. (Computer Science) (Sem-VI)

(w.e.f from Academic Year 2024-2025)

Class: T.Y.B.Sc. (Computer Science) (Sem-VI) **Paper Code: U**CSCO367
Title of Paper: Lab Course-I (on UCSCO361) **Paper:** VII Lab Course – I
Credit: 2 (3 Hr. Practical / Week/batch) **No of Practical : 1**4

Course Outcomes:

CO1: Develop a practical understanding of computer system simulation.

CO2: Develop implementation skills in processing page replacement techniques.

CO3: Develop a practical understanding of various disk scheduling Algorithms. CO4: Develop a practical understanding of File Structure.
CO5: Develop a practical understanding searching in Directory
CO6: Implement case studies on distributed system and Real Time Systems.
CO7: Encourage troubleshooting abilities to address issues related to memory management, disk partitions.

Assignment No.	**Name of Assignment**	**No of Practical Sessions Required**
1.	Memory Management	03
2.	File Management	04
3.	Disk Scheduling	03
4.	Real Time Scheduling	02
5.	Case Study on any one type of OS	02

Mapping of this course with Programme Outcomes

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

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

1. PO1 with All COs

CO1: Practical understanding of computer system simulation – (Weightage: 3)
Computer system simulation is crucial for analyzing, testing, and predicting the behavior of systems. This is a core concept that aligns strongly with applying fundamental principles across various applications, as simulations are widely used in areas like performance evaluation, resource management, and system design.

CO2: Implementation skills in processing page replacement techniques – (Weightage: 3)
Page replacement algorithms directly impact system performance, especially in memory management and operating systems. Mastery of these techniques is fundamental to optimizing a range of computer applications, making it strongly related to PO1.
CO3: Practical understanding of disk scheduling algorithms – (Weightage: 3)
Disk scheduling algorithms are fundamental for efficient data access in storage devices. Understanding these algorithms is essential for performance tuning in various applications such as databases, file systems, and real-time systems, making this CO strongly related to PO1.
CO4: Practical understanding of File Structure – (Weightage: 3)
File structures are at the core of data organization and retrieval in computer systems. Knowledge of file systems is applicable across almost every computing application, from databases to cloud storage systems, strongly aligning with the broad applicability of PO1.
CO5: Practical understanding of searching in Directory – (Weightage: 3)
Efficient search techniques in directories are key to optimizing system performance, especially in file systems and data management. This is a fundamental skill in computer science with applications in OS, databases, and search engines, making it strongly related to PO1.
CO6: Case studies on distributed systems and Real Time Systems – (Weightage: 2)
Distributed systems and real-time systems are specialized areas within computer science. While they require a strong understanding of fundamental principles, their application is more specific. Thus, they are moderately related to the broad scope of PO1.
CO7: Troubleshooting abilities related to memory management and disk partitions – (Weightage: 2)Troubleshooting is a practical skill that involves applying fundamental knowledge to solve specific issues. While it is important, it is more focused on resolving particular problems rather than covering a wide range of applications, making it moderately related to PO1.

2. PO2 with All COs
CO1: Practical understanding of computer system simulation – (Weightage: 2)
While simulations are essential for testing and analyzing solutions to computational problems, the emphasis in this CO is on understanding rather than designing and implementing solutions. Hence, it is moderately related to PO2.
CO2: Implementation skills in processing page replacement techniques – (Weightage: 3)
Page replacement techniques are a critical part of memory management, and implementing these efficiently is key to solving computational problems related to system performance. This CO is strongly related to PO2 since it requires both design and correct implementation of these algorithms.
CO3: Practical understanding of disk scheduling algorithms – (Weightage: 3)
Disk scheduling algorithms are essential for solving problems related to disk performance and storage access. Mastering these algorithms requires the design and correct implementation of solutions, making this CO strongly related to PO2.
CO4: Practical understanding of File Structure – (Weightage: 3)
Designing efficient file structures is crucial for solving problems related to data storage, retrieval, and performance optimization. This CO is strongly related to PO2 as it involves both understanding and implementing solutions to significant problems.
CO5: Practical understanding of searching in Directory – (Weightage: 2)
Searching in directories is important but is more focused on efficient retrieval rather than addressing significant computational challenges. While it involves problem-solving, the design aspect is more limited, making it moderately related to PO2.
CO6: Case studies on distributed systems and Real-Time Systems – (Weightage: 3)
This CO requires designing, implementing, and documenting solutions for complex systems such as distributed and real-time systems. It is directly related to solving significant computational problems, making it strongly related to PO2.
CO7: Troubleshooting abilities related to memory management and disk partitions – (Weightage: 2)Troubleshooting focuses on resolving specific issues, which involves applying existing knowledge rather than designing new solutions. It is moderately related to PO2 as it contributes to problem-solving but lacks the design and documentation aspects covered by PO2..

3. PO3 with All COs
CO1: Practical understanding of computer system simulation – (Weightage: 3)
Computer system simulation is a foundational concept that helps students grasp the behavior and performance of systems. It provides essential knowledge of how theoretical principles are applied in practice, making it strongly related to imparting the basics of the discipline.
CO2: Implementation skills in processing page replacement techniques – (Weightage: 3)
Page replacement techniques are a key concept in memory management and operating systems, which are foundational topics in computer science. Mastery of these techniques is essential for understanding the basics of system performance and optimization, strongly aligning with PO3.

CO3: Practical understanding of disk scheduling algorithms – (Weightage: 3)
Disk scheduling is a core component of understanding how storage systems operate efficiently. This CO teaches an important aspect of computer architecture and performance optimization, which are fundamental to the discipline, making it strongly related to PO3.
CO4: Practical understanding of File Structure – (Weightage: 3)
File structures are a fundamental part of how data is organized, stored, and accessed in computer systems. This CO directly contributes to the basic understanding of data management and system organization, making it strongly related to PO3.
CO5: Practical understanding of searching in Directory – (Weightage: 3)
Searching techniques are crucial for efficient data retrieval, which is a core concept in file systems and databases. This CO covers essential knowledge that is foundational to the discipline, making it strongly related to PO3.
CO6: Case studies on distributed systems and Real-Time Systems – (Weightage: 2)
Distributed systems and real-time systems are more specialized topics that build on fundamental concepts but are not typically considered part of the "basics" of computer science. Therefore, this CO is moderately related to PO3.
CO7: Troubleshooting abilities related to memory management and disk partitions – (Weightage: 2)Troubleshooting involves applying fundamental concepts to solve specific problems. While it is important, it focuses more on practical problem-solving than on imparting a broad understanding of the basics, making it moderately related to PO3.
4. PO4 with All COs
CO1: Practical understanding of computer system simulation – (Weightage: 2)
While understanding simulations can aid in professional growth, the emphasis is on the practical application in specific systems rather than professional development. However, the concept still moderately contributes to building skills useful for future learning and development.
CO2: Implementation skills in processing page replacement techniques – (Weightage: 2)
Page replacement techniques are vital for memory management and system optimization. Mastering these concepts moderately supports professional development by providing essential technical skills that can be applied in a variety of systems throughout one’s career.
CO3: Practical understanding of disk scheduling algorithms – (Weightage: 2)
Disk scheduling algorithms are key to improving storage system performance. This CO is moderately related to PO4 because it develops problem-solving skills that are valuable for professional growth, though its direct focus on continued development is limited.
CO4: Practical understanding of File Structure – (Weightage: 2)
Understanding file structures is foundational to data management and system performance, which is essential for continued professional development. However, the practical focus on file structures only moderately contributes to a broader professional growth context.
CO5: Practical understanding of searching in Directory – (Weightage: 2)
Directory searching techniques contribute to the practical understanding of system and data organization. This skill is important but has a moderate impact on long-term professional development compared to more advanced topics.
CO6: Case studies on distributed systems and Real-Time Systems – (Weightage: 3)
Case studies on distributed systems and real-time systems involve complex and advanced concepts that directly prepare students for professional development. These areas are highly relevant in today’s technological landscape and help professionals stay current, making this CO strongly related to PO4.

CO7: Troubleshooting abilities related to memory management and disk partitions – (Weightage:

3) Troubleshooting is a critical skill in professional development, as it equips individuals with problem-solving abilities necessary in many career paths. Addressing issues related to memory and disk partitions prepares students for handling real-world challenges, strongly relating this CO to PO
PO5 with All COs
CO1: Practical understanding of computer system simulation – (Weightage: 2)
Simulations can be used to evaluate and optimize systems for sustainability in areas such as energy consumption and resource allocation. While this understanding supports societal and environmental impact analysis, it does not directly focus on those issues, making it moderately related.
CO2: Implementation skills in processing page replacement techniques – (Weightage: 2)
Page replacement techniques, though critical for performance optimization, have only an indirect impact on societal or environmental contexts. However, efficient memory usage can contribute to reducing energy consumption in large-scale systems, making this CO moderately related to PO5.
CO3: Practical understanding of disk scheduling algorithms – (Weightage: 2)
Disk scheduling improves system efficiency and performance, which can have an indirect impact on reducing resource consumption in data centers. This CO moderately contributes to understanding sustainable development in IT contexts.
CO4: Practical understanding of File Structure – (Weightage: 2)
Efficient file structures can optimize data storage and retrieval, leading to reduced resource usage and energy consumption. However, the focus is primarily technical, making it moderately related to societal and environmental sustainability goals.
CO5: Practical understanding of searching in Directory – (Weightage: 2)
Similar to file structures, efficient searching algorithms contribute to reduced computational overhead and resource consumption. While it is a relevant technical skill, its impact on societal and environmental contexts is more indirect, making it moderately related to PO5.
CO6: Case studies on distributed systems and Real-Time Systems – (Weightage: 3)
Distributed systems, particularly those involving cloud computing, smart grids, and real-time systems, play a significant role in sustainable development. This CO strongly relates to PO5, as it involves analyzing real-world systems and their impact on society, resource management, and environmental sustainability.
CO7: Troubleshooting abilities related to memory management and disk partitions – (Weightage: 3)
Troubleshooting issues related to memory management and disk partitions can help improve system efficiency and resource usage, which has a direct impact on sustainability in IT. This CO strongly supports the goals of PO5 by equipping students with skills necessary to address challenges in sustainable IT solutions.
5. PO6 with All COs
CO1: Practical understanding of computer system simulation – (Weightage: 3)
Proficiency in computing requires understanding how systems behave under various conditions, which is what system simulation offers. This CO strongly relates to PO6 as it builds a practical skill set that is fundamental in the practice of computing.
CO2: Implementation skills in processing page replacement techniques – (Weightage: 3)
Efficient memory management through page replacement is a core computing skill. Developing these implementation skills contributes directly to proficiency in computing, making this CO strongly related to PO6.
CO3: Practical understanding of disk scheduling algorithms – (Weightage: 3)
Disk scheduling algorithms optimize resource usage in computing systems, and mastering these algorithms is essential for becoming proficient in computing practices. Thus, this CO strongly contributes to PO6.
CO4: Practical understanding of File Structure – (Weightage: 3)
Knowledge of file structures is critical for data management and system performance. This CO directly supports the development of core computing competencies, making it strongly related to PO6.
CO5: Practical understanding of searching in Directory – (Weightage: 2)
Searching algorithms are important, but this CO focuses more on specific skills within file systems rather than broader computing practices. It contributes to computing proficiency, but the focus is narrower, making it moderately related to PO6.
CO6: Case studies on distributed systems and Real-Time Systems – (Weightage: 3)
Understanding distributed and real-time systems is vital for advanced computing practices. Case studies that explore these topics contribute significantly to proficiency in computing, making this CO strongly related to PO6.

CO7: Troubleshooting abilities related to memory management and disk partitions – (Weightage: 3)
Troubleshooting is a crucial skill in computing. Developing the ability to diagnose and resolve issues related to memory management and disk partitions is essential for professional proficiency, making this CO strongly related to PO6.

6. PO7 with All COs

CO1: Practical understanding of computer system simulation – (Weightage: 3)

Simulation is a complex task requiring independent learning and research to understand system behavior. The ability to simulate and analyze systems is a valuable skill for employment in software and hardware companies, making this CO strongly related to PO7.

CO2: Implementation skills in processing page replacement techniques – (Weightage: 3)

Learning how to implement page replacement techniques involves significant research and independent study, as it requires an understanding of various algorithms and their applications. This is crucial for transitioning to technical roles, making this CO strongly related to PO7.

CO3: Practical understanding of disk scheduling algorithms – (Weightage: 3)

Disk scheduling algorithms are core concepts in systems design. Proficiency in this area demands research and independent study to stay updated on optimization techniques, strongly aligning this CO with PO7 for job preparedness.

CO4: Practical understanding of File Structure – (Weightage: 3)

File structures are essential in both software and hardware development. Mastering this area through independent research and learning is key for employment in various roles within these industries, making this CO strongly related to PO7.

CO5: Practical understanding of searching in Directory – (Weightage: 2)

While directory searching is a necessary skill, its contribution to independent research and study is more technical and focused on specific tasks rather than broad exploration. Thus, it is moderately related to PO7.

CO6: Case studies on distributed systems and Real-Time Systems – (Weightage: 3)

Case studies require in-depth independent research and analysis to understand real-world applications of distributed and real-time systems. This CO prepares students for employment by developing the capacity for independent study, making it strongly related to PO7.

CO7: Troubleshooting abilities related to memory management and disk partitions – (Weightage: 3)

Troubleshooting requires continuous learning, research, and independent thinking to resolve complex issues in memory management and disk partitions. This is highly valuable in professional environments, strongly relating this CO to PO7.

SYLLABUS (CBCS) FOR T.Y.B. Sc. (Computer Science) (Semester- VI)
(w.e.f from Academic Year 2024-2025)

Class: T.Y.B.Sc. (Computer Science) (Sem-VI) **Paper Code: U**CSCO368
Title of Paper: Lab. Course – II :Advanced Java Tech–Frameworks And Mini Project using JAVA.
Paper: VIII Lab Course –II
Credit: 2 (3 Hr. Practical/Week/batch) **No. of Practical:13**

Course Outcome:

1. Mastery of Hibernate Framework
2. Comprehensive Knowledge of Spring Framework
3. Advanced Spring Core Skills
4. Building Web Applications with Spring MVC
5. Efficient Development with Spring Boot
6. Integration of Hibernate with Spring
7. Building Micro services with Spring Cloud

LAB
WORKBOOK

Chapter No.	Chapter name with Topics
1.	JSON Set A - Assignment 1 Assignment 2Set B – Assignment 1 Assignment 2
2.	React Set A- Assignment 1 Assignment 2Set B – Assignment 1 Assignment 2
3.	Spring BootSetA- Assignment 1 Assignment 2Set B – Assignment 1 Assignment 2
4.	Hibernae Set A - Assignment 1 Assignment 2Set B – Assignment 1 Assignment 2
5.	Strut2 Set A- Assignment 1 Assignment 2Set B – Assignment 1 Assignment 2

Mapping of this course with Programme Outcomes

Course Outcomes	Program Outcomes						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	1	1	2	2
CO2	3	3	3	1	1	2	2
CO3	3	3	3	1	1	2	2
CO4	3	3	3	1	1	2	2
CO5	3	3	3	1	1	2	2
CO6	3	3	3	1	2	2	2
CO7	3	3	3	1	2	3	3

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

PO1 with All COs

CO1: PO1:3 (Strongly related): as computer system simulation involves applying mathematical andcomputational fundamentals to understand and model IT systems.

CO2: PO1: 3 (Strongly related): as implementing assembly programs requires a deep understanding of computerfundamentals and mathematics.

CO3: PO1: 3 (Strongly related): as working with shell commands and system calls requires knowledge ofcomputer fundamentals and IT applications.

CO4:PO1: 3(Strongly related): as CPU scheduling algorithms involve applying mathematical and computationalprinciples to optimize system performance.

CO5: PO1: 3 (Strongly related): as shell scripting and command-line interfaces are integral parts of ITapplications, requiring computer knowledge.

CO6: PO1: 3 (Strongly related): as implementing the Banker's algorithm involves applying mathematical andcomputational concepts to address system deadlock issues.

CO7: PO1: 3 (Strongly related): as troubleshooting in these areas requires applying computer knowledge andproblem-solving skills.

PO2 with All COs

CO1: PO2: 3 (Strongly related): as understanding computer system simulation is foundational to designing anddeveloping solutions in various IT contexts.

CO2: PO2: 3 (Strongly related): as the ability to implement assembly programs is a key aspect of designing anddeveloping solutions at a low level.

CO3: PO2: 3 (Strongly related): as familiarity with shell commands and system calls is essential for designing anddeveloping solutions involving command-line interfaces.

CO4: PO2: 3 (Strongly related): as knowledge of CPU scheduling algorithms is crucial for designing efficient andoptimized system solutions.

CO5: PO2: 3(Strongly related): as proficiency in shell scripting and command-line interfaces is valuable indesigning and developing practical solutions.

CO6: PO2: 3 (Strongly related): as implementing the Banker's algorithm is a specific design solution fordeadlock avoidance in system development.

CO7: PO2: 3 (Strongly related): as troubleshooting skills are essential for the ongoing development andmaintenance of solutions.

PO3 with All COs

CO1: PO3: 3 (Strongly related): as simulation tools are modern tools extensively used for understanding andmodeling complex computer systems

CO2: PO3: 3(Strongly related) as modern tools for assembly programming are essential for efficient and error-free implementation.
CO3: PO3: 3 (Strongly related): as proficiency in using modern command-line tools is crucial for effectiveutilization of shell commands and system calls.
CO4: PO3: 3(Strongly related): as modern tools are employed to simulate and analyze the performance of variousCPU scheduling algorithms.
CO5: PO3: 3 (Strongly related): as modern tools and editors are commonly used for efficient development andexecution of shell scripts.
CO6: PO3: 3 (Strongly related): as the implementation and simulation of algorithms often involve the use ofmodern programming tools and environments.
CO7: PO3: 3 (Strongly related): as modern debugging and profiling tools are essential for effectivetroubleshooting in various areas of system development.

PO4 with All COs
CO1: PO4: 1(Partially related): as computer system simulation, is more aligned with technical aspects than directenvironmental and sustainability considerations.
CO2: PO4: 1(Partially related):as assembly programming focuses on technical skills rather than directimplications for environmental and sustainability concerns.
CO3: PO4: 1(Partially related): as shell commands and system calls are more technical in nature and have limiteddirect connection to environmental and sustainability aspects.
CO4: PO4: 1 (Partially related): as CPU scheduling algorithms are primarily technical and do not have a strongdirect link to environmental and sustainability considerations.
CO5: PO4: 1 (Partially related): as shell scripting and command-line interfaces are technical skills with limiteddirect impact on environmental and sustainability aspects.
CO6:PO4: 1(Partially related): as the Banker's algorithm focuses on technical aspects of deadlock avoidancerather than environmental or sustainability implications.
CO7: PO4: 1 (Partially related): as troubleshooting skills are more aligned with technical problem-solving andhave limited direct connection to environmental and sustainability concerns.

PO5 with All COs
CO1: PO5: 1 (Partially related): as computer system simulation is more aligned with technical aspects, and itsconnection to ethical principles is indirect.
CO2PO5: 1(Partially related): as assembly programming primarily focuses on technical skills rather than directethical considerations.
CO3: PO5: 1 (Partially related): as shell commands and system calls are technical in nature and have limiteddirect connection to ethical principles.
CO4: PO5: 1 (Partially related): as CPU scheduling algorithms are primarily technical and do not have a strongdirect link to ethical considerations.
CO5: PO5: 1(Partially related): as shell scripting and command-line interfaces are technical skills with limiteddirect impact on ethical principles.
CO6: PO5: 2 (Moderately related): as the implementation of the Banker's algorithm may involve considerationsrelated to ethical and responsible programming practices.
CO7: PO5: 2 (Moderately related) as troubleshooting involves ethical considerations, such as maintaining theintegrity and security of systems.

PO6 with All COs
CO1: PO6: 2(Moderately related): as collaborative efforts may be involved in designing and interpretingsimulations.
CO2: PO6: 2 (Moderately related): as teamwork may be required for collaborative coding, code reviews, ortroubleshooting.
CO3: PO6: 2 (Moderately related): as working on command-line interfaces and scripting may

involvecollaboration and knowledge sharing within a team.
CO4: PO6: 2 (Moderately related): as understanding and implementing scheduling algorithms may requireteamwork for analysis and optimization.
CO5: PO6: 2 (Moderately related): as collaboration and sharing of scripts within a team may be necessary foreffective system management.
CO6: PO6: 2(Moderately related): as collaborative efforts may be needed to implement and test the Banker'salgorithm in a simulated environment.
CO7: PO6: 3(Strongly related): as troubleshooting often involves collaboration and collective problem-solvingwithin a team.

PO7 with All COs

CO1: PO7: 2 (Moderately related): as simulation skills may contribute to innovative problem-solving andemployability in technical roles.
CO2: PO7: 2 (Moderately related): as assembly programming skills may enhance employability in technical fieldsand contribute to innovative solutions.
CO3: PO7: 2 (Moderately related): as proficiency in shell commands and system calls is valuable foremployability and innovation in system administration and development.
CO4: PO7: 2 (Moderately related):as knowledge of CPU scheduling algorithms can contribute to innovativesolutions and employability in system optimization roles.
CO5:PO7: 2 (Moderately related): as scripting skills are often sought after in IT roles, contributing toemployability and potential innovation in automation.
CO6: PO7: 2 (Moderately related): as implementation of algorithms demonstrates technical competence relevantto employability and innovation.
CO7: PO7: 3 (Strongly related): as troubleshooting skills are critical for employability and can contribute toinnovation by solving complex technical challenges.

SYLLABUS (CBCS) FOR T.Y.B.Sc. (Computer Science) (Sem-VI)
(w.e.f. from Academic Year 2024-2025)

Class : T.Y.B.Sc. (Computer Science) (Sem-VI) **Paper Code :** CSCO369
Title of Paper : Lab. Course – III : Based on CSCO364and Mini Project Using PHP
Paper : IX - Lab. Course – III
Credits : 02 (3 Hr. Practical/Week/batch) **No. of Practicals:** 14
Prerequisite: Core PHP

Objectives:

- To learn the latest technologies used with PHP.
- To learn using JSON with PHP.
- To learn AJAX for applying dynamic changes to application.
- To learn package management.

Course Outcomes:

CO1. Build dynamic website.
CO2. Develop webpages handling multipage processing.CO3. Develop webpages using JavaScript and PHP.
CO4. Learn the latest technologies used with PHP.
CO5. Learn using JSON with PHP.
CO6. Learn AJAX for applying dynamic changes to application.
CO7. Learn package management

Assignment No.	Title
1.	Assignment on web techniques
2.	Assignment on web techniques
3.	Assignment on web techniques
4.	Assignment on web techniques
5.	Assignment on JSON with PHP
6.	Assignment on JSON with PHP
7.	Assignment on AJAX
8.	Assignment on AJAX
9.	Assignment on AJAX
10.	Assignment on Intermediate JavaScript
11.	Assignment on Intermediate JavaScript
12.	Assignment on Intermediate JavaScript
13.	Assignment on Intermediate JavaScript
14.	Assignment on Collaborative Platform

Mapping of this course with Programme Outcomes

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

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

Justification of mapping of PO1 with all COs

PO1: CO1: Building a dynamic website involves applying fundamental principles of Computer Science, such as programming, data management, and interactivity, aligning strongly with the overarching goal.
PO1: CO2. Developing webpages with multipage processing requires applying fundamental principles of Computer Science related to data flow and handling, strongly supporting the objective.
PO1:CO3. Developing webpages using JavaScript and PHP entails applying core principles of programming and web development, aligning directly with the goal of applying fundamental principles in Computer Science as stated in
PO1.CO4. Learning the latest technologies used with PHP is essential for staying current with advancements in web development, contributing directly to the application of fundamental principles in Computer Science as emphasized in
PO1:CO5. Learning to use JSON with PHP involves applying data interchange principles, connecting strongly with the application of fundamental principles in Computer Science, as outlined
PO1:CO6. Learning AJAX for dynamic changes aligns directly with the application of fundamental principles in Computer Science, particularly in the context of web development, supporting the goals.
PO1:CO7.: Learning package management is moderately related to the overarching goal of applying fundamental principles in Computer Science, as it involves managing dependencies and resources in software development.

Justification of mapping of PO2 with all COs

PO2:CO1 Building a dynamic website requires designing and implementing solutions to computational problems related to web development, aligning strongly with the goal of designing and implementing solutions.
PO2.CO2. Developing webpages with multipage processing involves designing and implementing solutions to computational problems related to data flow and processing, supporting the objectives of designing and implementing solutions
PO2:CO3. Developing webpages using JavaScript and PHP requires designing and implementing solutions to computational problems in the context of web development, aligning directly with the goals
PO2.:CO4. Learning the latest technologies with PHP involves staying current with advancements in technology, contributing directly to the ability to design and implement solutions to computational problems, as emphasized in PO2.CO5. Learning to use JSON with PHP is a specific application of handling data interchange, which aligns with the ability to design and implement solutions to computational problems, as stated
PO2.CO6.:Learning AJAX for dynamic changes in applications involves designing and implementing solutions tocomputational problems related to real-time updates, aligning directly with the objectives
PO2:CO7. Learning package management is moderately related to the ability to design and

implement solutions to computational problems, as it involves managing dependencies in software development, providing a supportive role.

Justification of mapping of PO3 with all COs

PO3: CO1.:Building a dynamic website involves practical application and implementation of foundational concepts, contributing strongly to the goal of imparting understanding in the basics of the discipline as stated in

PO3.CO2. Developing webpages with multipage processing requires understanding fundamental concepts in data flow and processing, aligning directly with the goal of imparting an understanding of basics as emphasized in PO3.CO3.Developing webpages using JavaScript and PHP involves practical application of programming concepts, supporting the goal of imparting an understanding of basics in the discipline as outlined

PO3:CO4. Learning the latest technologies with PHP contributes to staying current with advancements in the field, aligning directly with the objective of imparting an understanding of basics in the discipline

PO3:CO5. Learning to use JSON with PHP involves understanding data interchange concepts, aligning strongly with the goal of imparting an understanding of basics in the discipline as stated.

PO3:CO6.Learning AJAX for dynamic changes in applications involves understanding concepts of real-time updates, contributing directly to imparting an understanding of basics in the discipline as outlined.

PO3:CO7. Learning package management is moderately related to imparting an understanding of basics, as it involves understanding the organization and management of dependencies in software development, providing a supporting role.

Justification of mapping of PO4 with all COs

PO4: CO1.: Building a dynamic website involves practical skills development, moderately supporting the goal of preparing for continued professional development as specified

PO4: CO2.Developing webpages with multipage processing contributes to practical skills and understanding, moderately aligning with the goal of preparing for continued professional development as outlined

PO4:CO3. Developing webpages using JavaScript and PHP involves honing programming skills, moderately supporting the goal of preparing for continued professional development as per

PO4.:CO4. Learning the latest technologies with PHP is directly aligned with staying current in the field, stronglysupporting the goal of preparing for continued professional development as emphasized

PO4.CO5.Learning to use JSON with PHP involves additional skills related to data interchange, moderately supporting the goal of preparing for continued professional development as stated

PO4:CO6. Learning AJAX for dynamic changes in applications contributes to practical skills, moderately aligning with the goal of preparing for continued professional development as outlined.

PO4:CO7.: Learning package management is moderately related to preparing for continued professional development, as it involves understanding tools and practices in software development, providing a supportiverole in PO4.

Justification of mapping of PO5 with all COs

PO5: CO1.Building a dynamic website is moderately related to understanding the impact of IT solutions in societal and environmental contexts, as it involves practical skills development that may have implications for sustainability.

PO5: CO2: Developing webpages with multipage processing is moderately related to understanding the impact of IT solutions, as it involves considering the efficiency and resource utilization, which can have implications for sustainability.

PO5:CO3. Developing webpages using JavaScript and PHP is moderately related to understanding the impact of IT solutions, as the technologies used may influence the environmental and societal aspects of web applications.

PO5:CO4.: Learning the latest technologies with PHP is strongly related to understanding the impact of IT solutions, as staying current with technologies is crucial for addressing evolving societal and environmental challenges in the field.

PO5:CO5.:Learning to use JSON with PHP is moderately related to understanding the impact of IT

solutions, as it involves handling data interchange which may have implications for efficient and sustainable data practices.
PO5:CO6.:Learning AJAX for dynamic changes is moderately related to understanding the impact of IT solutions, as it involves real-time updates that may influence the efficiency and user experience with potential implications for sustainability.
PO5:CO7.: Learning package management is moderately related to understanding the impact of IT solutions, as it involves efficient management of dependencies and resources in software development, which can have implications for sustainability.

Justification of mapping of PO6 with all COs

PO6: CO1. Building a dynamic website is directly aligned with developing proficiency in computing, as itinvolves practical application of various computing concepts, languages, and technologies.
PO6::CO2. Developing webpages with multipage processing is strongly related to developing proficiency incomputing, as it requires understanding and implementing computational solutions for efficient data processing.
PO6::CO3: Developing webpages using JavaScript and PHP directly contributes to developing proficiency in computing, as it involves applying programming skills and using technologies commonly employed in computing practices.
PO6:CO4:Learning the latest technologies used with PHP is strongly related to developing proficiency in computing, as staying updated with technologies is crucial for effective and efficient computing practices.
PO6:CO5: Learning to use JSON with PHP is strongly related to developing proficiency in computing, as it involves handling data interchange—a fundamental aspect of computing applications.
PO6:CO6.: Learning AJAX for dynamic changes is strongly related to developing proficiency in computing, as it involves implementing real-time updates—an advanced aspect of computing practices.
PO6:CO7.Learning package management is strongly related to developing proficiency in computing, as it involves essential skills for organizing, managing dependencies, and optimizing software development practices.

Justification of mapping of PO7 with all COs

PO7:CO1: Building a dynamic website is moderately related to developing the capacity for independent study andresearch, as it involves practical skills development, contributing to the overall goal of transitioning to employment.
PO7: CO2: Developing webpages with multipage processing is moderately related to developing independent study and research capacity, as it requires understanding and implementing computational solutions, contributing to skills necessary for employment transition.
PO7:CO3. Developing webpages using JavaScript and PHP is moderately related to the goal of developing independent study and research capacity, as it involves practical application of programming skills for employment readiness.
PO7:CO4. Learning the latest technologies with PHP is moderately related to developing independent study and research capacity, as staying updated with technologies is essential for a successful transition to employment.
PO7:CO5.: Learning to use JSON with PHP is moderately related to developing independent study and research capacity, as it involves understanding data interchange—an aspect relevant to employment readiness.
PO7:CO6. Learning AJAX for dynamic changes is moderately related to the goal of developing independent study and research capacity, as it involves exploring advanced concepts beneficial for employment transition.
PO7:CO7. Learning package management is moderately related to developing independent study and research capacity, as it involves acquiring skills for organizing and managing dependencies in software development—a relevant aspect for employment readiness.