K.K.Wagh Institute of Engineering Education and Research, Nasik (Autonomous w.e.f. A.Y. 2022-23)
Pattern of Course Structure: 2022 Semester – IV S. Y. B. Tech Computer Science and Design

Course Code	Course Type	Title of Course	Teaching Scheme Hrs./week			Assessment Scheme of Marks								Credits			
			TH	TU	PR	In Sem	End Sem	CCE	TU	TW	PR	OR	Total	TH	TU	PR /OR	Total
SMH222111	BSC	Applied Mathematics –III	3	1	-	20	60	20	25	-	-	-	125	3	1	-	4
CSD222012	DCC	Advanced Data Structures	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
CSD222013	DCC	Operating Systems	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
CSD222014	DCC	Computer Networks	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
CSD222015	LHSM	Software Engineering and Project Management	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
CSD222016	ASM	Client Side Technology	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CSD222017	DCC	Advanced Data Structures Lab	-	-	4	-	-	-	-	25	50	-	75	-	-	2	2
CSD222018	DCC	Operating Systems Lab	-	-	2	-	-	-	-	25	25	-	50	-	-	1	1
CSD222019	DCC	Computer Networks Lab	-	-	2	-	-	-	-	25	25	-	50	-	-	1	1
CSD222020	PSI	Project Based Learning - Client Side Technology	-	-	2	-	-	-	-	25	-	-	25	-	-	1	1
Total			**16**	**1**	**10**	**100**	**300**	**100**	**25**	**100**	**100**	**-**	**725**	**15**	**1**	**5**	**21**

K. K. Wagh Institute of Engineering Education and Research, Nashik
(Autonomous fromAcademicYear2022-23)

S.Y.B.Tech. Computer Science and Design
Pattern 2022 Semester: IV
SMH222111: Applied Mathematics-III

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory: 03hrs/week **Tutorial:01hr/week**	**03** **01**	**ContinuousComprehensive Evaluation: 20Marks** **InSem Exam: 20Marks** **EndSemExam: 60Marks** **Tutorial: 25Marks**

Prerequisite Courses:- Applied Mathematics-I

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

	Course Outcomes	**Bloom's Level**
CO1	Understand basic concept of Statistic	2-Understand
CO2	Understand basic concept of probability distribution	2-Understand
CO3	Apply the basic concepts of statistics to real life problems	3-Apply
CO4	Apply the basic concepts of probability distribution theory to real life problems	3-Apply
CO5	Analyze real life problems by using theory of statistics and Probability distribution	4-Analyze

COURSE CONTENTS

Unit I	**Descriptive Measures**	**(08hrs+2hrsTutorial)**	**COs Mapped - CO1, CO2, CO3**

Measures of central tendency (Mean, Median, Mode), Measures of dispersion (Variance, Standard Deviation, Range), coefficients of variation, Moments, Skewness and Kurtosis.

Unit II	**Random Variable & Distribution Functions**	**(08hrs+2hrsTutorial)**	**COs Mapped -CO1, CO2, CO3**

Random Variable, Distribution functions (Continuous and discrete), Properties of distribution function, Probability mass function (p.m.f.), Probability density function (p.d.f.) and Cumulative distribution function (Continuous and discrete).

Unit III	**Mathematical Expectation and Generating Function**	**(08hrs+2hrsTutorial)**	**COs Mapped - CO3, CO4, CO5**

Mathematical Expectation, Properties of expectation, Moment Generating Function

Unit IV	**Probability Distributions**	**(08hrs+2hrsTutorial)**	**COsMapped - CO4, CO5**

Discrete distributions: Geometric, Binomial, Poisson, Uniform Distribution Continuous distribution: Normal distribution, Standard Normal, Uniform.			
Unit V	**Correlation and Regression**	**(08hrs+2hrsTutorial)**	**COs Mapped - CO1, CO2**
Covariance, Concept of correlation, Karl Pearson's Coefficient of Correlation, Rank Correlation coefficient, Spearman's rank Correlation coefficient. Regression: Lines of Regression, Regression coefficients.			
TextBooks			
1. B.V.Ramana,"Higher Engineering Mathematics", TataMcGraw-Hill. 2. B.S.Grewal,"Higher Engineering Mathematics",Khanna Publication,Delhi. 3. AdvancedEngineeringMathematics,7e,bypeterV.O"Neil(ThomsonLearning) 4. IntroductiontoProbabilityandStatistics forEngineersandScientists,5e, bySheldonM.Ross(ElsevierAcademicPress)			
ReferenceBooks			
1. Erwin Kreyszig,"Advanced Engineering Mathematics",WileyEastern Ltd. 2. P.N.Wartikar and J.N.Wartikar,"Applied Mathematics"(VolumesI and II), Pune Vidyarthi Griha Prakashan, Pune. 3. AdvancedEngineeringMathematics,2e,by M.D.Greenberg(PearsonEducation).			

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr.No.	**Components for Continuous Comprehensive Evaluation**	**Marks Alloted**
1	Assignments (Total3Assignment, Unit I and II 20marks,Unit III and IV20marks and UnitV- 10marks &50markswillbeconvertedto10Marks)	10
2	Tests on each unit using LearniCo (Each test for15 Marks and total will be converted out of 10Marks)	10

List of Tutorial Assignments		
Sr.No.	Title	CO Mapped
1	Examples on measures of central tendency and measures of dispersion	CO1,CO2, CO3
2	Examples on Probability density function (p.d.f.) and Cumulative distribution function (Continuous and discrete).	CO1,CO2, CO3
3	Examples on Probability mass function (p.m.f.) and Probability density function (p.d.f.)	CO1,CO2
4	Examples on Cumulative distribution function (Continuous and discrete).	CO1,CO2
5	Solve problems on measures of central tendency using MATLAB	CO1,CO2, CO3,CO4
6	Solve problems on measures of dispersion using MATLAB	CO1,CO2, CO3,CO4
7	Examples on Mathematical Expectation, Properties of expectation,	CO1,CO2, CO3
8	Examples on Moment generating function	CO1,CO2, CO3

9	Examples on Geometric, Binomial, Poisson, Uniform Distribution	CO3, CO4,CO5
10	Examples on Normal, Standard Normal &Uniform distribution	CO3, CO4,CO5
11	Examples on Covariance, Karl Pearson's Coefficient of Correlation, Rank Correlation coefficient, Spearman's rank Correlation coefficient.	CO4,CO5
12	Examples on Lines of regression, Regression coefficients.	CO4,CO5

Guidelines for Tutorial/Termwork Assessment		
Sr.No.	**Components for Tutorial/Termwork Assessment**	**Marks Allotted**
1	Assignment on Computational Software	5
2	Tutorial (Each tutorial carries 15marks)	15
3	Attendance (Above95%:05Marks,below75%: 0Marks)	5

K.K.Wagh Institute of Engineering Education and Research, Nashik
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S. Y. B. Tech. Computer Science and Design
Pattern 2022 Semester: IV
CSD222012: Advanced Data Structures

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory : 03 hrs/week	**03**	**Continuous Comprehensive Evaluation: 20 Marks** **InSem Exam: 20 Marks** **EndSem Exam: 60 Marks**

Prerequisite Courses:- CSD222001: Fundamentals of Data structures, CSD222003:Discrete Mathematics

Companion Course:- CSD222017: Advanced Data Structures Lab

Course Objectives:

- To understand basic concepts of non linear data structures such as trees, graphs
- To study the concepts of hash table and files
- To learn advanced data structures such as indexing techniques and multiway search trees

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

	Course Outcomes	**Bloom's Level**
CO1	Make use of non-linear data structures such as graph and trees to solve a given problem	3-Apply
CO2	Use different representations of symbol table	3-Apply
CO3	Apply the hash table and it's collision resolution methods and different file handling techniques	3-Apply
CO4	Use efficient indexing techniques and multiway search trees to store and maintain data	3-Apply
CO5	Analyze an algorithm used for solving a given problem	4-Analyze

COURSE CONTENTS

Unit I	**Graphs**	**(08 hrs)**	**COs Mapped - CO1, CO5**

Graph- Basic Concepts, Storage representation- Adjacency matrix, Adjacency list, Adjacency multi list
Traversals-Depth First Search (DFS) and Breadth First Search(BFS)
Spanning Tree - Connected components, Minimum spanning Tree, Greedy algorithms- Prim's and Kruskal's for MST
Dikjtra's Single source shortest path, Algorithm for Topological ordering
Self Study-Data structure used in Webgraph and Google map.

Unit II	**Trees**	**(08 hrs)**	**COs Mapped - CO1, CO5**

Trees- Basic terminology, General tree and its representation, Representation using sequential and linked organization**, C**onverting tree to binary tree, Types of trees
Binary tree- Properties, ADT, Representation using sequential and linked organization, Binary tree traversals (recursive and non-recursive)- inorder, preorder, postorder, Depth first and breadth first search, Operations on binary tree, Formation of binary tree from given traversals,
Applications of Binary trees

Binary Search Tree (BST) - Concept, Definition, Comparison with binary tree, BST operations, applications of BST
Threaded binary tree, Expression tree, Huffman Tree (Concept and Use), Decision Tree, Game tree.

Unit III	**Symbol Table**	**(07 hrs)**	**COs Mapped – CO2, CO5**

Symbol Table-Representation of Symbol Tables- Static tree table and Dynamic tree table, Weight balanced tree - Optimal Binary Search Tree (OBST), OBST as an example of Dynamic Programming
Height Balanced Trees- AVL tree. Red-Black Tree, Splay Tree.

Unit IV	**Hash tables and Files**	**(07 hrs)**	**COs Mapped – CO3, CO5**

Hash table Concepts-Hash function, bucket, Collision, Probe, Synonym, Overflow, Open hashing, Closed hashing, Perfect hash function, Load density, Full table, Load factor, Rehashing, Basic operations, Issues in hashing
Hash functions- Properties of good hash function, Division, Multiplication, Extraction, Mid-square, folding and universal
Collision resolution strategies-Open addressing and Chaining, Hash table overflow- Open addressing and Chaining, Closed addressing and Separate chaining.
Files-Concept, Need, Primitive operations. Sequential file organization, Direct access file, Indexed sequential file organization-Concept and Primitive operations
Self Study- SkipList- Representation, Searching.

Unit V	**Indexing and Multiway Trees**	**(06 hrs)**	**COs Mapped – CO4, CO5**

Indexing and Multiway Trees- Indexing, Indexing techniques-Primary, Secondary, Dense, Sparse
Multiway search trees, B-Tree- Insertion, Deletion, B+ Tree - Insertion, Deletion, Use of B+ tree in Indexing
Heaps- Concept, Insert, Delete operation, Heap sort, Heap as a Priority Queue.
Self Study- Trie Tree

Text Books

1. Horowitz, Sahani, Dinesh Mehata, "Fundamentals of Data Structures in C++", Galgotia Publisher, ISBN: 8175152788, 9788175152786
2. M Folk, B Zoellick, G. Riccardi, "File Structures", Pearson Education, ISBN:81-7758-37-5

Reference Books

1. Sartaj Sahani, "Data Structures, Algorithms and Applications in C++", Second Edition, University Press, ISBN: 9788173715228
2. G A V Pai, "Data Structures and Algorithms", McGraw-Hill Companies, ISBN:9780070667266

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Quiz on Unit 1, Unit-2, Unit-3 (Quiz 10 marks on each unit and will be converted to 10 Marks)	10
2	Theory assignment on Unit- 4 & 5 (10 marks assignment on unit 4 and 5 each and that will be converted in to 10 Marks)	10
	Total	**20**

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S. Y. B. Tech. Computer Science and Design
Pattern 2022 Semester: IV
CSD222013 : Operating Systems

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory : 03 hrs/week	**03**	**Continuous Comprehensive Evaluation: 20 Marks** **InSem Exam: 20 Marks** **EndSem Exam: 60 Marks**

Prerequisite Courses:- CSD222001**:**Fundamentals of data structures

Companion Course:- CSD222018: Operating Systems Lab

Course Objectives:

- To understand operating system services, types of operating systems and shell scripts
- To study process scheduling algorithms and multithreading techniques
- To get acquainted with the concepts of synchronization, deadlock prevention and avoidance algorithms
- To learn concepts of memory management and I/O management techniques
- To introduce Linux operating systems

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

	Course Outcomes	**Bloom's Level**
CO1	Explain operating system services, types of operating systems and basic shell commands	2- Understand
CO2	Illustrate the concept of process scheduling algorithms to solve scheduling problems	2- Understand
CO3	Compare algorithms for deadlock detection, prevention and avoidance	2- Understand
CO4	Use algorithms for page replacement and I/O management	3- Apply
CO5	Describe Linux commands and utilities such as grep, tr, sed, awk	2- Understand

COURSE CONTENTS

Unit I	**Fundamental concepts of operating systems**	**(07 hrs)**	**COs Mapped - CO1**

Introduction, Operating systems services
Types of operating systems: Batch, Time-sharing, Network, Distributed and real time.
O**perating system operations: D**ual mode and multimode, System calls, Types of system calls.
Bash shell scripting: Basic shell commands and scripting language.

Unit II	**Process management**	**(08 hrs)**	**COs Mapped - CO2**

Process: Concept, Process control block, Process state diagram, Inter process communication
Process scheduling: Types, First come first serve, Shortest job first, Round robin, Priority based scheduling
Threads: Multi core programming, Multithreading models, Implicit threading, Threading issues

Unit III	**Process coordination**	**(07 hrs)**	**COs Mapped - CO3**

Synchronization: The critical-section problem, Peterson's solution, Synchronization hardware, Mutex locks, Semaphores, Monitors

Classic problems of synchronization: Producer-consumer problem, Reader/writer problem, Dining philosopher problem

Deadlock: Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance and detection, Recovery from deadlock.

Unit IV	**Memory Management**	**(07 hrs)**	**COs Mapped - CO4**

Memory Partitioning: Fixed partitioning, Dynamic partitioning

Contiguous Memory allocation techniques: First fit, Best fit, Worst fit, Swapping, Structure of the page table, Segmentation, Demand paging

Page Replacement algorithms: First in first out, Optimal page replacement, Least recently used translation look aside buffer

Unit V	**I/O management and Introduction to Linux**	**07 hrs**	**COs Mapped – CO4, CO5**

I/O devices, Disk scheduling algorithms: First come first serve, Shortest seek time first algorithm, SCAN, Circular-SCAN

Introduction to Linux: Essential features, File systems and directories, Linux shell commands such as pwd, cd, ls, cat, rm, cp, mkdir and Linux utilities such as tr, sed, grep, egrep, awk. File access rights.

Text Books

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", WILEY, ISBN:978-81-265-5427-0, 9th Edition
2. William Stallings, "Operating System: Internals and Design Principles", Prentice Hall, ISBN 10: 0-13-380591-3, ISBN 13: 978-0-13-380591-8, 8th Edition

Reference Books

1. Tom Adelstein and Bill Lubanovic, "Linux System Administration", O'Reilly Media, ISBN 10: 0596009526, ISBN 13: 978-0596009526
2. Harvey M. Deitel, "Operating Systems", Prentice Hall, ISBN 10: 0131828274, ISBN 13: 978-0131828278

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Quiz on Unit 1, Unit-2, Unit-4, Unit 5 (Quiz 15 marks each and will be converted to 15 Marks)	15
2	Theory assignment on Unit-3 (One Assignment on Unit III of 10 marks will be converted to 5 Marks)	05
	Total	**20**

S. Y. B. Tech. Computer Science and Design
Pattern 2022 Semester: IV
CSD222014 : Computer Networks

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory :03 hrs./week	**03**	**Continuous Comprehensive Evaluation: 20Marks** **InSem Exam: 20Marks** **EndSem Exam: 60Marks**

Prerequisite Courses: - CSD222004:Digital Electronics and Logic Design

Companion Course :- CSD222019: Computer Networks Lab

Course Objectives:

- To understand fundamental concepts of networking standards, protocols, hardware and technologies
- To understand the basics of error detection including parity, checksums, and CRC
- To understand the client/server model and key application layer protocols
- To learn sockets programming and how to implement client/server applications
- To understand the concepts of reliable data transfer, principles of routing, semantics and syntax of IP

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

	Course Outcomes	**Bloom's Level**
CO1	Summarize fundamental concepts of computer network, architectures, models, technologies and security aspects	2 - Understand
CO2	Illustrate functions of HTTP, DNS and SMTP protocols.	2-Understand
CO3	Explain the Transport Layer functions such as port addressing, socket programming Connection Management, Error and Flow control mechanism	2-Understand
CO4	Demonstrate routing protocols and mechanisms	2-Understand
CO5	Apply concepts of framing, error detection and control at data link layer	3-Apply

COURSE CONTENTS

Unit I	**Introduction to Computer Network**	**(08hrs)**	**COs Mapped - CO1**

Introduction

Definition, Goals and applications of networks, **Types of Networks**: LAN, MAN, WAN, Wireless networks, **Network Architectures**: Client-Server, Peer to peer, Hybrid .protocol, Design issues for the network layers. **Network Models**: The OSI reference model, TCP/IP model

Network Topologies and design: Network hardware devices: Bridge, Switch, Router, Gateway, Access Point.

Cast: Unicast, Multicast, Broadcast, Types of transmission medium, Signal transmission and **Line coding scheme**: Manchester and Differential Manchester encoding, Frequency Hopping(FHSS) , Direct Sequence Spread Spectrum (DSSS)

Switching Techniques: Circuit, message and packet switching, multiplexing.

Network Performance: Bandwidth and latency, Delay and bandwidth product, High speed networks and application performance needs.

Basic network Security Concepts: Need, attacks, types of network security and tools.

Topics for Self Study **:** Network hardware devices: Bridge, Switch, Router, Gateway, Access Point

Unit II	**Application Layer**	**(07hrs)**	**COs Mapped - CO2**

Web and HTTP, Web Caching , DNS ,Email: SMTP, MIME, POP3, Webmail,
FTP, **TELNET**,
DHCP, SNMP
Basic Concepts of Data Compression and Cryptography

Unit III	**Transport Layer**	**(07hrs)**	**COs Mapped - CO3**

Process to Process Delivery, Services, Socket programming.
Elements of Transport Layer Protocols: Addressing, Connection establishment, Connection release, Flow control and buffering, Multiplexing, congestion control.
Transport Layer Protocols: TCP and UDP, SCTP, RTP, Congestion control and quality of service (QoS), Differentiated services
TCP and UDP for Wireless networks.

Topics for Self Study**:** Connection establishment, Connection release

Unit IV	**The Network Layer**	**(07hrs)**	**COs Mapped - CO4**

IP Protocol: Classes of IP, IPv4, IPv6, Network Address Translation, Sub-netting, CIDR.
Network layer Protocols: ARP, RARP, ICMP, and IGMP.
Network Routing and Algorithms: Static Routing, Dynamic Routing, Distance Vector Routing, Link State Routing, Path Vector.
Routing. Protocols: RIP, OSPF, BGP, and MPLS.
Routing in MANET: AODV, DSR, And Mobile IP.

Unit V	**Data Link Layer**	**(07hrs)**	**COs Mapped - CO5**

Design Issues: Services to network layer, Framing.
ARQ strategies: Error Detection and correction, Parity Bits, Hamming codes (11/12-bits) and CRC.
Flow Control Protocols: Unrestricted simplex, Stop and Wait, Sliding Window protocol.
WAN Connectivity: PPP and HDLC.
MAC Sub layer: Multiple Access Protocols: Pure and Slotted ALOHA, CSMA, WDMA, CSMA/CD, CSMA/CA, Binary Exponential Back-off algorithm,
Introduction to Ethernet IEEE 802.3, IEEE 802.11 a/b/g/n, IEEE 802.15 and IEEE 802.16 Standards.

Topics for self-study: CSMA/CD, CSMA/CA

Text Books

1. Kurose and Ross, "Computer Networking- A Top-Down Approach", Pearson, ISBN-10:0132856204
2. Andrew Tanenbaum "Computer Networks", Prentice Hall, ISBN:0-07-058408-7

Reference Books

1. Behrouz Forouzan, "Data Communication and Networking", McGraw Hill Publication, ISBN:0-07-058408-7
2. D. Comer, "Computer Networks and Internets", Pearson , ISBN: 0133587932
3. Behrouz Forouzan, "TCP/IP Protocol Suite", McGraw Hill Publication, ISBN 0-07-337604-3
4. Willam Stallings," Cryptography and Information Security: Principles and Practice", Pearson,Fourth edition, ISBN**:** 9789353942564

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Components for Continuous Comprehensive Evaluation	**Marks Allotted**
Quiz on Unit 1, Unit-2, Unit-4, Unit 5 (Quiz 15 marks each and will be converted to 15 Marks)	15
Theory assignment on Unit-3 (One Assignment on Unit III of 10 marks will be converted to 5 Marks)	5
Total	**20**

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S. Y. B. Tech. Computer Science and Design
Pattern 2022 Semester: IV
CSD222015: Software Engineering and Project Management

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory : 03 hrs/week	**03**	**Continuous Comprehensive Evaluation:** 20 Marks **InSem Exam:** 20 Marks **EndSem Exam:** 60 Marks

Prerequisite Courses:-CSD222001:Fundamentals of Data Structures, CSD222005:Programming Paradigms and Java Programming

Course Objectives:
- To understand the need for the software life cycle and its implications
- To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements
- To understand project management through the life cycle of the project and current practices in the IT industry

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

	Course Outcomes	**Bloom's Level**
CO1	Identify appropriate process model for software development.	3-Apply
CO2	Model software requirements for software development.	3-Apply
CO3	Make use of emerging trends for software project management.	3-Apply
CO4	Utilize project metrics for software project estimation and process improvement	3-Apply
CO5	Analyze software risks involved in project development.	4-Analyze

COURSE CONTENTS

Unit I	**Introduction to Software Engineering and Software Process Models**	**(08hrs)**	**CO1**

Software Engineering: The Nature of Software, Defining Software, Software Engineering Process, Software Engineering Practice.
Process Models: A Generic Process Model, Process Assessment and Improvement, Prescriptive process models.
Agile Development: Agility, Agility and Cost of change, Agile process, Extreme Programming (XP), Other Agile Process Models- Scrum, Feature Driven Development (FDD)

Self-Study Topic: Use of Agile to enhance business processes by major players such as Sky, Philips and JP Morgan Chase

Unit II	**Understanding Requirements and Design Concepts**	**(07hrs)**	**CO2**

Requirement Engineering: Establishing the Groundwork**,** Eliciting Requirements, Developing the use cases, Building the Requirement model, Negotiate Requirements, Validating Requirements, and Requirement Analysis.
Design Concepts: Design within the context of Software Engineering, The Design Process, Design Concepts, and The Design Model.

Self-Study Topic: Software Requirement Specification of Library Management System

Unit III	**Emerging Trends in Software Engineering & Project Management Concepts**	**(07hrs)**	**CO3**

Emerging Trends: Technology evolution, Observing Software Engineering Trends, Identifying soft trends, Technology directions, Tools related trends.

Project Management Concepts: The management spectrum, People, The Product, The Process, The Project, The W^5HH Principle

Unit IV	Project Estimation and Software Process Improvement	(07hrs)	CO4

Project Metrics: Software Measurement, Metrics for Software Quality, Metrics for Small Organizations

Estimation for Software Projects: Observation on Estimation, The Project Planning Process, Software Scope and Feasibility, Resources, Software Project Estimation, Decomposition Techniques, Empirical Estimation Models, Specialized Estimation Techniques

Software Process Improvement: Introduction, Approaches to SPI, Maturity Models - Capability Maturity Model (CMM), Capability Maturity Model Integration (CMMI)

Unit V	Project Scheduling and Risk Management	(07hrs)	CO5

Project Scheduling: Basic Principles, Task set for Software Project, Task Network, Scheduling

Risk Management: Reactive versus Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinement, The RMMM Plan

Self-Study Topic: Risk management for E-commerce website

Text Books

1. Roger Pressman, "Software Engineering: A Practitioner's Approach"||, McGraw Hill, ISBN 0-07-3375
2. Ian Sommerville,"Software Engineering", Addison and Wesely, ISBN 0-13-703515-2.

Reference Books

1. Rajib Mall, "Fundamentals of Software Engineering", Prentice Hall India, ISBN-13: 978-8120348981
2. Pankaj Jalote, "An Integrated Approach to Software Engineering", Springer, ISBN 13: 9788173192715.

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Quiz on Unit-1, Unit-2, Unit-4 and Unit-5 (Quiz 15marks each and will be converted to 15 marks)	15
2	Theory assignment on Unit-3 (One assignment on Unit-3 of 10 marks will be converted to 5 marks)	05
	Total	**20**

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S. Y. B. Tech. Computer Science and Design **Pattern 2022 Semester: IV** **CSD222016: MOOC – Client Side Technology**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory: MOOC	**01**	
Prerequisite Courses:- CSD222006:Design Thinking		
Companion Course:- CSD222020: Project Based Learning –Client Side Technology		
Course Objectives: • To understand the concepts of front end web technologies. • To understand client side technologies		
Course Outcomes: On completion of the course, students will be able to–		

	Course Outcomes	**Bloom's Level**
CO1	Build web pages using HTML	3-Apply
CO2	Apply CSS for styling web pages	3-Apply
CO3	Use of Java Script for web development	3-Apply
CO4	Use Angular for web development	3-Apply
CO5	Use front-end frameworks for web development	3- Apply

COURSE CONTENTS

Unit I	**Client side scripting - Hyper Text Markup Language**	**(02hrs)**	**COs Mapped - CO1**
The Internet, basic internet protocols, the World Wide Web, HTTP Request message, HTTP response message, web clients, web servers. HTML: Introduction, HTML elements: headings, paragraphs, line break, colors and fonts, links, frames, lists, tables, images and forms, Difference between HTML and HTML5. https://drive.google.com/drive/folders/18j8w9gcUey0EOgDEoqVpxIdtEfA69E3p			
Unit II	**Cascaded Style Sheets**	**(02hrs)**	**COs Mapped - CO2**
Introduction to Style Sheet, CSS features, CSS core syntax, Style sheets and HTML, Style rule cascading and inheritance, text properties. CSS Color, CSS Background Image, CSS Selectors, CSS BOX model, introduction to Bootstrap. https://drive.google.com/drive/folders/1oFTQKtBlnZB3dSHOiCKgQtYY4-VkXS76			
Unit III	**Client Side Technology - Java Script**	**(02hrs)**	**COs Mapped - CO3**
Java Script: Introduction to JavaScript, Document Object Modelling, Benefits of JavaScript, Fundamentals: Variables, Constants, Data Types, Objects, Functions, Conditional Statements, Loops, Switch Case. https://drive.google.com/drive/folders/1_szX6sGFwtJ14KppmPU70flrFPVczAvp			
Unit	**Client Side Technology - Angular**	**(03hrs)**	**COs Mapped -**

IV			**CO4**
Introduction to Single Page Application, Angular, Angular routing Angular directives, Angular components , One-way data binding for read-only data, Two-way data binding, Events, Format data with pipes, Shared service, Use routing to navigate among different views and their components. https://drive.google.com/drive/folders/1GkH-8FNEm1HmC7Urr5m83znkg5_bDldw			
Unit V	**Front End Technologies**	**(03hrs)**	**COs Mapped - CO5**
Introduction to React JS, React JS installation, React Component, React Lifecycle, React Events, Introduction to Node.js, Features of Node.js, Node.js Architecture, Node.js module, JSON File, Node.js Operators, Node.js functions, Node.js Objects, Node.js file system, Node.js Events, Node.js HTTP module. https://drive.google.com/drive/folders/15EkXqxAzMe8L0Gzt9Hm1ybOkez0yE5VD			
Learning Material			
1. Jeffrey C. Jackson ," Web Technologies: A Computer Science Perspective", Second Edition, Pearson Education, 2007, ISBN 978-0131856035			

K.K.Wagh Institute of Engineering Education and Research, Nashik
(Autonomous from Academic Year 2022-23)

S. Y. B. Tech. Computer Science and Design **Pattern 2022 Semester: IV** **CSD222017: Advanced Data Structures Lab**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical : 04 hrs/week	**02**	**Term Work: 25 Marks** **Practical Exam: 50 Marks**
Prerequisite Courses:- CSD222001:Fundamentals of Data structures, CSD222003:Discrete Mathematics		
Companion Course: CSD222012: Advanced Data Structures		

Course Objectives:

- To understand basic concepts of non linear data structures such as trees, graphs
- To study the concepts of hash table and files
- To learn advanced data structures such as indexing techniques and multiway search trees

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

	Course Outcomes	**Bloom's Level**
CO1	Make use of non-linear data structures such as graph and trees to solve a given problem	3-Apply
CO2	Use different representations of symbol table	3-Apply
CO3	Apply the hash table and it's collision resolution methods and different file handling techniques	3-Apply
CO4	Use efficient indexing techniques and multiway search trees to store and maintain data	3-Apply
CO5	Analyze an algorithm used for solving a given problem	4-Analyze

List of Laboratory Experiments / Assignments		
Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	**Flight management**: There are flight paths between cities. If there is a flight between city A and city B then there is an edge between the cities. The cost of the edge can be the time that flight takes to reach city B from A, or the amount of fuel used for the journey. Write a menu driven C++ program to represent this as a graph using adjacency matrix and adjacency list. The node can be represented by the airport name or name of the city. Check whether cities are connected through flight or not. Compare the storage representation.	CO1, CO5
2	**Graph traversal**: The area around the college and the prominent landmarks of it are represented using graphs. Write a menu driven C++ program to represent this as a graph using adjacency matrix /list and perform DFS and BFS.	CO1, CO5

3	**Activity on vertex(AOV) network**: Sandy is a well organized person. Every day he makes a list of things which need to be done and enumerates them from 1 to n. However, some things need to be done before others. Write a C++ code to find out whether Sandy can solve all his duties and if so, print the correct order	CO1, CO5
4	**Binary search tree:** Write a menu driven C++ program to construct a binary search tree by inserting the values in the order give, considering at the beginning with an empty binary search tree, After constructing a binary tree- i. Insert new node, ii. Find number of nodes in longest path from root, iii. Minimum data value found in the tree iv. Search a value v. Print values in ascending and descending order	CO1, CO5
5	**Expression tree**: Write a menu driven C++ program to construct an expression tree from the given prefix expression eg. +--a*bc/def and perform following operations: 1. Traverse it using post order traversal (non recursive) 2. Delete the entire tree 3. Change a tree so that the roles of the left and right pointers are swapped at every node	CO1, CO5
6	**A Dictionary using BST**: A Dictionary stores key and value pairs Data: Set of (key, value) pairs, Keys are mapped to values, Keys must be comparable, Keys must be unique. Standard Operations: Insert(key, value), Find(key), Delete(key) Write a menu driven C++ program to provide above standard operations on dictionaries and provide a facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Binary Search Tree for implementation	CO1, CO5
7	**Tree using traversal sequence**: Write a C++ program to construct the binary tree with a given preorder and inorder sequence and Test your tree with all traversals	CO1, CO5
8	**A Dictionary using AVL**: A Dictionary stores key and value pairs Data: Set of (key, value) pairs, Keys are mapped to values, Keys must be comparable, Keys must be unique. Standard Operations: Insert(key, value), Find(key), Delete(key) Write a menu driven C++ program to provide above standard operations on dictionaries and provide a facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Height balanced tree(AVL) and find the complexity for finding a keyword	CO2, CO5
9	**Telephone book management**: Consider the telephone book database of N clients. Write a menu driven C++ program to make use of a hash table implementation to quickly look up a client's telephone number. Use of two collision handling techniques and compare them using number of comparisons required to find a set of telephone numbers	CO3, CO5

10	**A Dictionary using Hash table**: A Dictionary stores key and value pairs Data: Set of (key, value) pairs, Keys are mapped to values, Keys must be comparable, Keys must be unique. Standard Operations: Insert(key, value), Find(key), Delete(key) Write a menu driven C++ program to provide above standard operations on dictionaries Write a menu driven C++ program to provide all the functions of a dictionary (ADT) using hashing and handle collisions using chaining.	CO3, CO5
11	**Sequential File:** The students' club members (MemberID, name, phone, email) list is to be maintained. The common operations performed include these: add member, search member, delete member, and update the information. Write a menu driven C++ program that uses file operation to implement the same and perform all operations.	CO3, CO5
12	**Min/max Heaps**: Marks obtained by students of second year in an online examination of a particular subject are stored by the teacher. Teacher wants to find the minimum and maximum marks of the subject. Write a menu driven C++ program to find out maximum and minimum marks obtained in that subject using heap data structure. Analyze the algorithm	CO4, CO5
13	**A Dictionary using STL map and Hashmap**: Implement Dictionary (key and value pairs) using using **STL map in C++** and **Hashmap in Java** and compare all dictionary implementation 1. BST 2. AVL 3. User defined Hash table 4. STL Map 5. Hashmap in Java Use Visual C++ and Java Compiler	CO1, CO2, CO3, CO5
14	Study Assignment: 1. Explain Data structures used in whatsapp in details 2. Consider following real time application and explain in detail the combinations of data structures and algorithms used in it. Social media applications require efficient and scalable data structures to manage user-generated content, facilitate user interactions, and ensure the reliability and availability of the platform. The primary challenge in designing data structures for social media applications is to accommodate the massive volume of data generated by users, while providing fast and responsive access to that data. Some specific challenges that data structures in social media applications must address include: • Handling user interactions such as likes, comments, and shares, and ensuring the integrity and consistency of those interactions. • Supporting fast and flexible search and filtering of content based on user preferences, geographic location, hashtags, and other criteria. • Managing relationships between users, such as friends, followers, and groups, and providing fast and efficient access to that information.	CO1 to CO5

Mini Project		
	Student has to perform one mini project based on concepts covered in the course, Write a detailed problem statement for your project, Design and implement a code for the same using appropriate data Structures.	CO1 to CO5
Additional Programming Problems		
1	**Skip Lists:** Write a C++ program to create a skip list for a given set of elements. Find the element in the set that is closest to some given value. (note: Decide the level of element in the list Randomly with some upper limit)	CO3, CO5
2	**Huffman algorithm**: Write a C++ program to implement a file compression algorithm that uses a binary tree. Your program should allow the user to compress and decompress messages containing alphabets using the standard Huffman algorithm for encoding and decoding.	CO1, CO5
3	**Tour management**: Tour operators organize guided bus trips across Maharashtra. Tourists may have different preferences. Tour operators offer a choice from many different routes. Every day the bus moves from starting city S to another city F as chosen by the client. On this way, the tourists can see the sights alongside the route traveled from S to F. Clients may have preference to choose the route. There is a restriction on the routes that the tourists may choose from, the bus has to take a short route from S to F or a route having one distance unit longer than the minimum distance. Two routes from S to F are considered different if there is at least one road from a city A to a city B which is part of one route, but not of the other route. Write a C++ program to solve above problem.	CO1, CO5
4	**Optimal Binary search tree**: Given sequence k = k1 <k2 < ... <kn of n sorted keys, with a search probability pi for each key ki . Write a C++ program to build the Binary search tree that has the least search cost given the access probability for each key.	CO2, CO5
5	**Trie** : Write a C++ program to store a collection of strings that have to be inserted in the trie and perform search operation	CO4, CO5
Guidelines for Laboratory Conduction		
Use of coding standards and Hungarian notation, proper indentation and comments. Use of open source software is to be encouraged. Operating System recommended:- Linux or its derivative Programming tools recommended: - Open Source line gcc/g++ (Visual C++ compiler for few assignments and note the difference)		
Guidelines for Student's Lab Journal		
The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, problem statement, theory concepts in brief, algorithm, flowchart, test cases and conclusions). Program codes with sample outputs shall be submitted in soft form.		
Guidelines for Termwork Assessment		

Continuous assessment of laboratory work shall be based on the overall performance of a student.
Assessment of each laboratory assignment shall be based on rubrics that include
R1- timely completion (10),
R2- understanding of assignment (10) and
R3- presentation/clarity of journal writing (10) (Coding standard, Indentation, Hungarian notation, input validation etc)
Mini Project assessment will be based on Teamwork, Communication skill, Social relevance of mini project, Ethics followed.

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S. Y. B. Tech. Computer Science and Design
Pattern 2022 Semester: IV
CSD222018: Operating Systems Laboratory

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical : 02 hrs/week	**01**	**Term Work: 25 Marks** **Practical Exam : 25 Marks**

Prerequisite Courses:- CSD222001**:**Fundamentals of Data Structures

Companion Course:- CSD222013: Operating Systems

Course Objectives:

- To understand operating system services, types of operating systems and shell scripts
- To study process scheduling algorithms and multithreading techniques
- To get acquainted with the concepts of synchronization, deadlock prevention and avoidance algorithms
- To learn concepts of memory management and I/O management techniques
- To introduce Linux operating systems

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

	Course Outcomes	**Bloom's Level**
CO1	Explain operating system services, types of operating systems and basic shell commands	2- Understand
CO2	Illustrate the concept of process scheduling algorithms to solve scheduling problems	2- Understand
CO3	Compare algorithms for deadlock detection, prevention and avoidance	2- Understand
CO4	Use algorithms for page replacement and I/O management	3- Apply
CO5	Describe Linux commands and utilities such as grep, tr, sed, awk	2- Understand

Sr. No.	**List of Laboratory Assignments/ Experiments**	**COs Mapped**
1	Write a shell script for implementation of control flow statements.	**CO1**
2	Write a shell script to find factorial of a given number.	**CO1**
3	Write a C program to compute and print the average waiting time, average turnaround time and CPU burst times for the given list of processes. Display/print the Gantt chart for first come first serve, shortest job first, priority scheduling and round robin scheduling algorithm.	**CO2**
4	Write a C program to implement inter process communication using shared memory, pipes, named pipes and signals	**CO2**
5	Write a C program to implement producer-consumer problem	**CO3**
6	Write a C program to implement page replacement algorithms such as first in first out, least recently used and optimal page replacement	**CO4**
7	Installation of Linux operating system and basic configuration.	**CO5**
8	Assignment on Unix basic commands such as pwd, ls, cat, redirection and pipes and Unix utilities like tr, sed, grep, egrep, awk.	**CO5**

9	Execute following AWK operations on the text file : 1 Print the lines which match the given pattern. 2 Splitting a Line Into Fields 3 To find the length of the longest line present in the file 4 Printing the lines with more than specified characters	**CO5**

Guidelines for Laboratory Conduction

Use of coding standards and Hungarian notation, proper indentation and comments.
Use of open source software is to be encouraged. Operating System recommended: Linux or its derivative. Programming tools recommended: Open Source line gcc/g++

Guidelines for Student's Lab Journal

The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, problem statement, theory concepts in brief, algorithm, flowchart, test cases and conclusions). Program codes with sample outputs shall be submitted in soft form.

Guidelines for Term work Assessment

Continuous assessment of laboratory work shall be based on overall performance of a student. Assessment of each laboratory assignment shall be based on rubrics that include
R1- timely completion (10),
R2- understanding of assignment (10) and
R3- presentation/clarity of journal writing (10).

S. Y. B. Tech. Computer Science and Design
Pattern 2022 Semester: IV
CSD222019 : Computer Networks Lab

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical : 02 hrs./week	**01**	**Term work: 25 Marks** **Practical Exam:25 Marks**

Prerequisite Courses: - CSD222004: Digital Electronics and Logic Design

Companion Course:- CSD222014: Computer Networks

Course Objectives:

- To understand fundamental concepts of networking standards, protocols, hardware and technologies
- To understand the basics of error detection including parity, checksums, and CRC
- To understand the client/server model and key application layer protocols
- To learn sockets programming and how to implement client/server applications
- To understand the concepts of reliable data transfer, principles of routing, semantics and syntax of IP

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

	Course Outcomes	**Bloom's Level**
CO1	Summarize fundamental concepts of computer network, architectures, models, technologies and security aspects	2 - Understand
CO2	Illustrate functions of HTTP, DNS and SMTP protocols.	2-Understand
CO3	Explain the transport layer functions such as port addressing, socket programming, Connection management, Error and flow control mechanism.	2-Understand
CO4	Demonstrate routing protocols and mechanisms	2-Understand
CO5	Apply concepts of framing, error detection and control at data link layer	3-Apply

List of Laboratory Experiments / Assignments

Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	Study of different types of network cables and implement the Cross-wired cable and straight through cable using clamping tool.	**CO1**
2	Study of basic network commands and network configuration commands.	**CO1**
3	Study of Campus Wide area Networking of your college	**CO1**
4	Study of different network simulators : Cisco packet tracer , Wireshark and NS2 1. NS2 • NS2 Basics, • Create simple network with 3 nodes (2 senders and 1 receiver: TCP /FTP • Create star topology :TCP as well as UDP 2 Cisco Packet tracer tool	**CO1**

	• simple topology • complex topology 3 Wireshark • Packet Monitoring	
5	Setup a WAN which contains wired as well as wireless LAN using a packet tracer tool. Demonstrate transfer of a packet from LAN 1 (wired LAN) to LAN 2 (Wireless LAN).	**CO1**
6	Configure HTTP Server using simulation tool	**CO2**
7	Design a file transfer protocol server configuration in cisco packet tracer and checking the connectivity for uploading and downloading the file from remote PC using Cisco packet tracer tool	**CO2**
8	Write a program for DNS lookup. Given an IP address as input, it should return URL and vice-versa.	**CO2**
9	Write a client-server program using TCP socket for wired network to - a. Say Hello to Each other b. File transfer c. Calculator	**CO3**
10	Write a program using UDP Sockets to enable file transfer (Script, Text, Audio and Video one file each) between two machines.	**CO3**
11	Write a program to demonstrate sub-nets and find the subnet masks	**CO4**
12	Write a program for error detection and correction for 7/8 bits ASCII codes using Hamming Codes or CRC	**CO5**

Guidelines for Laboratory Conduction

- Use of open source software is encouraged. Based on the concepts learned.
- Operating System recommended: -64-bit Open-source Linux or its derivative
- Programming tools recommended:- Open-Source C/C++/JAVA Programming tool like G++/GCC, NS-2
- Simulation tools recommended:- Wireshark/Ethereal and Packet Tracer

Guidelines for Student's Lab Journal

- The laboratory assignments are to be submitted by student in the form of journal.
- Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable),conclusion/analysis.
- Program codes with sample output of all performed assignments are to be submitted as softcopy.

Guidelines for Term work Assessment

1. Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student.
2. Each experiment from lab journal is assessed for thirty marks based on three rubrics.
3. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks.

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S. Y. B. Tech. Computer Science and Design
Pattern 2022 Semester: IV
CSD222020: Project Based Learning –Client Side Technology

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical : 02 hrs/week	**01**	**Term Work : 25 Marks**

Prerequisite Courses :- CSD222006: Design Thinking

Companion Course:- CSD222016: Client Side Technology

Course Objectives:

- To develop critical thinking and problem solving ability by exploring and proposing solutions to realistic/social problem
- To apply alternative approaches for selecting client side technologies
- To emphasizes learning activities that are long-term, inter-disciplinary and student-centric
- To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism
- To develop an ecosystem that promotes entrepreneurship and research culture among the students through web based development environment

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

	Course Outcomes	**Bloom's Level**
CO1	Identify the real life and societal problem	3-Apply
CO2	Build web pages using client side technologies	3-Apply
CO3	Make use of Angular for web development	3-Apply
CO4	Make use of front-end frameworks for web development	3-Apply

List of Tasks

Sr. No.	**Tasks**	**CO Mapped**
1	Creating teams, assigning roles and responsibilities for project based learning	**CO1**
2	Brain storming: Ideation, setting actionable problem statement, identify stakeholders, people/ organization, problems and opportunities, prepare questionnaire and discuss with stakeholders	**CO1**
3	**Use suitable Client Side Technology to design and develop mini project**	
3.1	Design and develop GUI using client side technologies Hint: HTML,CSS	**CO2**
3.2	Update task 3.1 using Java Script to apply dynamic behavior Hint: Java Script	**CO2**
3.3	Rebuild task 3.2 into a single page application using Angular	**CO3**
3.4	Redesign task 3.3 and develop dynamic application using Node.JS and React	**CO4**

Guidelines for Laboratory Conduction

Client Side Technology (MOOC) is companion course for Project-Based Learning (PBL) - Client Side Technology. PBL is an instructional approach designed to give students an opportunity to develop knowledge and skills through engaging projects set around challenges and problems they may face in the real world. It is more than just projects. With these, students investigate and respond to an authentic, engaging, and complex problem and providing feasible solution using client side web technologies. It requires mentoring by faculty throughout the semester for successful completion of the project tasks selected by the students per batch. The batch should be divided into sub-groups of 4 to 5 students. Idea presentation and implementation under this course is carried throughout the semester and evaluation is done on the basis of internal continuous assessment.

Guidelines for Student's Lab Journal

The laboratory tasks are to be completed by students in the form of a report. Report consists of Certificate, table of contents, title, team structure, surveys conducted, problem statement, use cases, concepts in brief, conclusions. A mini project shall be presented in the soft form and report shall be submitted to the mentor for evaluation.

Guidelines for Term work Assessment

It is recommended that all activities should be recorded regularly, regular assessment of work need to be done and proper documents need to be maintained by both students as well as mentor. Continuous Assessment Record is to be maintained by all mentors.

Recommended rubrics for weekly assessment / evaluation:

Task 1 : Creating teams, assigning roles and responsibilities for project based learning Task 2 : Ideation	10 M
Task 3.1: Design and develop GUI using client side technologies	15 M
Task 3.2: Update task 3.1 using Java Script to apply dynamic behavior	15 M
Task 3.3: Rebuild task 3.2 into a single page application using Angular	15 M
Task 3.4: Redesign task 3.3 and develop dynamic application using Node.JS and React	15 M
Report Writing	30 M
Task 3.1, 3.2, 3.3, 3.4 : 15 marks each (R1 : Timely completion and R2: Implementation)	