



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

● **Summary of Credits and Total Marks for U.G. Programme:**

Semester	S.Y. B.Tech	
	Total Credits (TH+PR/OR/TU)	Total Marks
III	21	725
IV	21	725
Total	42	1450

● **Description of various Courses:**

Type of Course	Description	Type of Course	Description
ESC	Engineering Science Course - Workshop - Drawing- Fundamentals of different branches	DCC	Department Core Course
BSC	Basic Science Courses	DEC	Department Elective Course
LHSM	Liberal arts, Humanities, Social Sciences and Management courses	OEC	Open Elective Courses of other technical or emerging areas /Courses designed by Industry
PSI	Project work, Seminar, Internship, PBL	IMC	Induction and Mandatory Courses
NC/AC	Non Credit Courses	ASM	Additional Specialized / MOOCs



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

Course Code	Course Type	Title of Course	Teaching Scheme Hrs./week			Evaluation Scheme and Marks								Credits			
			TH	TU	PR	In Sem	End Sem	CCE	TU	TW	PR	OR	Total	TH	TU	PR*	Total
COM222001	DCC	Fundamentals of Data Structures	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
COM222002	DCC	Computer Graphics	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
COM222003	DCC	Discrete Mathematics	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
COM222004	ESC	Digital Electronics and Logic Design	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
COM222005	DCC	Programming Paradigms and Java Programming	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
COM222006	LHSM	Design Thinking	1	-	-	-	-	-	-	25	-	-	25	1#	-	-	1
COM222007	DCC	Data Structures Lab	-	-	4	-	-	-	-	25	50	-	75	-	-	2	2
COM222008	ESC	Digital Electronics Lab	-	-	2	-	-	-	-	25	25	-	50	-	-	1	1
COM222009	DCC	Programming Paradigms and Computer Graphics Lab	-	-	2	-	-	-	-	25	25	-	50	-	-	1	1
COM222010	PSI	Python Programming Lab	-	-	2	-	-	-	-	25	-	-	25	-	-	1	1
Total			16	-	10	100	300	100	-	125	100	-	725	16	-	5	21

Note: Credits are as per the Teaching Scheme

* Credits for PR are linked with PR/OR/TW/TU

This credit will be assessed as TW



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 *	Total
SMH222111	BSC	Applied Mathematics –III	3	1	-	20	60	20	25	-	-	-	125	3	1	-	4
COM222012	DCC	Advanced Data Structures	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
COM222013	DCC	Operating Systems	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
CSD222014	DCC	Computer Networks	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
COM222015	LHSM	Software Engineering and Project Management	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
COM222016	ASM	Client Side Technology	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COM222017	DCC	Advanced Data Structures Lab	-	-	4	-	-	-	-	25	50	-	75	-	-	2	2
COM222018	DCC	Operating Systems Lab	-	-	2	-	-	-	-	25	25	-	50	-	-	1	1
CSD222019	DCC	Computer Networks Lab	-	-	2	-	-	-	-	25	25	-	50	-	-	1	1
COM222020	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

Note: Credits are as per the Teaching Scheme

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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: III
COM222001: Fundamentals of 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:- FYE221010: Programming in C, FYE221011: Programming in CPP		
Companion Course:- COM222007: Data Structures Laboratory		
Course Objectives: <ul style="list-style-type: none"> To understand basic concepts and terminology of algorithms and data structures To study data structures arrays, linked lists, stack and queues To learn searching and sorting methods 		
Course Outcomes: On completion of the course, students will be able to–		
	Course Outcomes	Bloom's Level
CO1	Describe the fundamental concepts and terminology of data structures and algorithms, including arrays, linked lists, stacks, queues and searching and sorting algorithms	2-Understand
CO2	Demonstrate the ability to choose and implement appropriate data structures such as Array, linked list, stack and queue to solve a given problem	3-Apply
CO3	Implement algorithms for array and linked list processing such as insertion, and deletion using C++	3-Apply
CO4	Use stack and / or queue to solve the given problem	3-Apply
CO5	Compare different searching and sorting algorithms based on their performance, strengths, and limitations.	3-Apply
COURSE CONTENTS		
Unit I	Introduction to Algorithms and Data Structures	(06 hrs)
		COs Mapped - CO1
Algorithms -Introduction, Characteristics, Analysis of algorithms Complexity of algorithms - Space complexity, Time complexity, Big O notation Data, Data objects, Data types, Data structure, Abstract Data Types (ADT), Primitive and non-primitive, linear and nonlinear, static and dynamic, persistent and ephemeral data structures		
Unit II	Sequential Organization	(08 hrs)
		COs Mapped - CO1, CO2, CO3
Sequential Organization - Concept, Array as an abstract data type, Memory representation and address calculation, Inserting and deleting an element, Multidimensional arrays, Ordered lists Single Variable Polynomial -Representation, evaluation and addition Sparse Matrix -Sparse matrix representation, addition, simple transpose, fast transpose String - Operations using arrays. Pattern matching algorithm- Naive pattern matching, Rabin Karp algorithm		

Unit III	Linked Organization	(08 hrs)	COs Mapped - CO1, CO2, CO3
Linked lists -Concept, Linked list as an Abstract data type, Comparison of sequential and linked organizations Realization of Linked list - using arrays, using dynamic memory management, header node, advantages and disadvantages of linked list Linked list operations -Insert a node, delete a node, traverse, copy, reverse, concatenate, delete list Types of linked list -Linear, circular, Doubly linked list and operations, Representation of a Polynomial using linked list Generalized Linked List (GLL) -Concept, Representation of polynomial and sets.			
Unit IV	Stacks and Queues	(08 hrs)	COs Mapped - CO1, CO2, CO4
Stacks -Concept, Stack as an ADT, Representation of stacks using array and linked list, stack operations, Multi-stacks Applications of Stack - Polish notation, expression conversion and evaluation, Processing of function calls and Returns Recursion - Concept, Types of recursion-Direct recursion, Indirect recursion, Tail recursion, Linear recursion, Tree recursion, Comparison of recursion and iterations, Backtracking algorithmic strategy, use of stack in backtracking Queues - Concept, Queue as ADT, Realization of queues using arrays and linked list, Circular queue, Deque, Multi-queues, Linked queue and operations. Applications of Queue : Scheduling, Josephus problem Self Study - Four Queens problem.			
Unit V	Searching and Sorting	(06 hrs)	COs Mapped - CO1, CO5
Searching Techniques - Sequential search, Binary search, Fibonacci search. Sorting - Internal and external sorting, Sort order, Stability, Efficiency, Number of passes Sorting methods - Bubble sort, Insertion sort, Selection sort, Quick sort, Shell sort, Bucket sort, Radix sort, Merge sort, Comparison of Sorting Methods. Self Study - Jump search.			
Text Books			
1. Horowitz, Sahani, Dinesh Mehata, "Fundamentals of Data Structures in C++", Galgotia Publisher, ISBN: 8175152788, 9788175152786 2. J. Tremblay, P. Soresan, "An Introduction to data Structures with applications", TMH Publication, 2nd Edition, 1984. ISBN:0-07-462471-7			
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 and 5 (10 marks assignment on unit 4 and 5 each and that will be converted in to 10 Marks)	10
	Total	20



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: III COM222002: Computer Graphics			
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: - FYE 221001:Applied Mathematics			
Companion Course:- COM222009: Programming Paradigms and Computer Graphics Lab			
Course Objectives: <ul style="list-style-type: none">To acquaint the learner with the basic concepts of Computer GraphicsTo learn the various algorithms for generating and rendering graphical figuresTo get familiar with the graphical transformation			
Course Outcomes: On completion of the course, students will be able to–			
	Course Outcomes		Bloom’s Level
CO1	Explain basic concepts of computer graphics to generate line, circle & polygon		2-Understand
CO2	Make use of algorithms for polygon filling and polygon clipping		3-Apply
CO3	Apply geometric transformations on 2D and 3D objects		3-Apply
CO4	Make use of color models and hidden surface removal algorithms for rendering geometrical objects		3-Apply
CO5	Develop graphical applications using Curves and Fractals		3-Apply
COURSE CONTENTS			
Unit I	Scan Conversion Algorithms and Display Files	(08hrs)	CO1
Introduction: Graphics Primitives - Pixel, Resolution, Aspect Ratio, Frame Buffer, Display Devices, Applications of Computer Graphics. Scan conversion: Line drawing algorithms: Digital Differential Analyzer (DDA), Bresenham. Circle drawing algorithms: Bresenham. Display Files: Structure, Algorithms and Display File Interpreter. Primitive operations on display file. Segment: Segment table, Segment creation, closing, deleting and renaming, Visibility. Self-Study Topic: Video Display Devices			
Unit II	Polygons, Windowing and Clipping	(07hrs)	CO2
Polygons: Introduction to polygon. Inside test- Even-Odd, Winding Number. Polygon Filling: Seed fill, Scan line fill. Windowing and clipping: Introduction to windowing, 2-D clipping: Cohen – Sutherland line Clipping algorithm, Sutherland Hodgeman Polygon clipping algorithm, Weiler Atherton Polygon Clipping algorithm.			
Unit III	2D, 3D Transformations and Projections	(07hrs)	CO3
2-D transformations: Homogeneous Coordinates, Translation, scaling, rotation and shear, rotation about an arbitrary point. 3-D transformations: Translation, scaling, rotation, rotation about an arbitrary axis. Projections : Parallel (Oblique: Cavalier, Cabinet and orthographic: isometric, diametric, trimetric) and			

Perspective (Vanishing Points – 1 point, 2 point and 3 point)			
Unit IV	Colour Models and Hidden Surface Removal	(07hrs)	CO4
Colour models: Properties of Light, CIE chromaticity Diagram, RGB, HSV, CMY.			
Hidden Surface Removal: Introduction, Back face detection and removal, Algorithms: Depth buffer (z), Depth sorts (Painter), Area subdivision (Warnock)			
Self-Study Topic: Color Selection and Application			
Unit V	Curves and Fractals	(07hrs)	CO5
Curves: Introduction, Interpolation and Approximation, Blending function, B-Spline curve, Bezier curve			
Fractals: Introduction, Fractal generation: Koch curve, Hilbert curve, Applications.			
Text Books			
<ol style="list-style-type: none"> 1. S. Harrington, Computer Graphics A Programming Approach, 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 – 100472 – 6. 2. D. Rogers, Procedural Elements for Computer Graphics, 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4. 			
Reference Books			
<ol style="list-style-type: none"> 1. D. Rogers, J. Adams, Mathematical Elements for Computer Graphics, 2nd Edition, Tata McGrawHill Publication, 2002, ISBN 0 – 07 – 048677 – 8. 2. J. Foley, V. Dam, S. Feiner, J. Hughes, Computer Graphics Principles and Practice, 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9. 3. D. Hearn, M. Baker, Computer Graphics – C Version, 2nd Edition, Pearson Education, 2002, ISBN 81 – 7808 – 794 – 4. 			

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)	5
	Total	20



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S. Y. B. Tech. Computer Science and Design Pattern 2022 Semester: III COM222003: Discrete Mathematics			
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:- FYE 221001:Applied Mathematics-I			
Course Objectives: <ul style="list-style-type: none">● To understand the concepts of relations and functions● To understand the use of propositional logic and number theory● To study concepts of graph and trees● To study algebraic structures			
Course Outcomes: On completion of the course, students will be able to—			
	Course Outcomes		Bloom's Level
CO1	Solve problems using propositional logic and number theory		3- Apply
CO2	Use relations or functions to solve problems		3- Apply
CO3	Apply graph theory to represent data and solve associated problems		3- Apply
CO4	Apply the concepts of trees to generate minimum spanning tree and prefix code		3- Apply
CO5	Use algebraic structures to solve problems		3- Apply
COURSE CONTENTS			
Unit I	Propositional Logic and Number Theory	(06hrs)	COs Mapped - CO1
Propositional Logic: Propositional equivalences, Predicates and quantifiers, Applications of propositional logic, Mathematical induction, Recursive definition Number Theory: Introduction, Divisibility and Modular arithmetic, Greatest common divisors, Congruence, Applications of number theory.			
Unit II	Relations and Functions	(08hrs)	COs Mapped - CO2
Relations: Properties, n-ary relations, Represent relations, Equivalence relations, Partial orderings, partitions, Hasse diagram, lattices, Chains and anti-chains, Closures of relations, Transitive closure and Warshall's algorithm Functions: Types of functions, properties, Pigeonhole principle Recurrence relations, Generating functions.			
Unit III	Graph Theory	(08 hrs)	COs Mapped - CO3
Graph terminology, Types of graphs, Representation of graphs, Graph isomorphism, Planar graphs, Path and circuit, Euler path and circuit, Hamilton path and circuit, Single source shortest path- Dijkstra's algorithm, Maximum flow labeling algorithm.			

Unit IV	Trees	(07 hrs)	COs Mapped - CO4
Trees terminology, Properties of tree, Prefix codes and Huffman coding, Cut sets, Tree traversal, Spanning trees, Minimum spanning tree, Kruskal's and Prim's algorithms.			
Unit V	Algebraic Structures and Coding Theory	(07hrs)	COs Mapped - CO5
The structure of algebra, Algebraic systems, Semi groups, Monoids, Groups, Homomorphism and normal subgroups, Congruence relations, Rings, Integral domains and fields, Coding theory.			
Text Books			
1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw-Hill, ISBN 978- 0-07-288008-3 2. C. L. Liu, Elements of Discrete Mathematics, Tata McGraw-Hill, ISBN 10:0-07-066913-9 3. Bernard Kolman, Robert C. Busby and Sharon Ross, "Discrete Mathematical Structures", Prentice-Hall of India /Pearson, ISBN: 0132078457, 9780132078450.			
Reference Books			
1. N. Biggs, "Discrete Mathematics", 3rd Ed, Oxford University Press, ISBN 0 –19-850717–8 2. NarsinghDeo, "Graph with application to Engineering and Computer Science", Prentice Hall of India, 1990, 0 – 87692 – 145 – 4.			

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)	5
	Total	20



S. Y. B. Tech. Computer Science and Design Pattern 2022 Semester: III COM222004: Digital Electronics and Logic Design			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory :03 hrs/week		03	Continuous Comprehensive Evaluation: 20Marks InSem Exam: 20Marks EndSem Exam: 60Marks
Prerequisite Course:- FYE221007 : Fundamentals of Electronics Engineering			
Companion Course:- COM222008: Digital Electronics Lab			
Course Objectives: <ul style="list-style-type: none">To study logic minimization techniquesTo develop skills for design and implementation of combinational logic circuitsTo develop skills for design and implementation of sequential logic circuits			
Course Outcomes: On completion of the course, students will be able to–			
	Course Outcomes		Bloom's Level
CO1	Solve the problem of minimization using K Map and Quine Mc-Clusky method of Boolean expression		3-Apply
CO2	Build combinational circuits using AND-OR logic		3-Apply
CO3	Build combinational circuits using SSI and MSI logic		3-Apply
CO4	Explain applications of Flip Flops, registers and shift registers		2-Understand
CO5	Develop sequential logic circuits using Flip Flops and MSI logic		3-Apply
COURSE CONTENTS			
Unit I	Logic Minimization Technique	(08hrs)	COs Mapped - CO1
Signed Binary Number Representation: Signed magnitude, 1's complement, 2's complement, Binary arithmetic, Boolean expression: sum of product and product of sum form, Don't care conditions, Minimization of Boolean expression using K-map(upto 4 variables) and Quine Mc-Clusky method			
Unit II	Introduction to Combinational Circuits	(06hrs)	COs Mapped - CO2
Introduction to combinational circuits, Codes & Code converter : BCD, Excess-3, Gray code, Half-adder, Full adder, Half subtractor, Full subtractor, Universal adder/subtractor, 4 bit binary adder (IC 7483), Look ahead carry generator, BCD adder			
Unit III	Combinational Logic Design	(06hrs)	COs Mapped - CO3
Multiplexers, Cascading multiplexers, Demultiplexers, Encoder, Decoder, Implementation of Boolean expression using multiplexer, Demultiplexer, Comparators, Parity generator and Checker. Programmable Logic Devices: ROM, PLA, PAL			
Unit IV	Introduction to Sequential Circuits	(08hrs)	COs Mapped - CO4
Difference between Combinational and Sequential Circuits, Flip-Flops: SR, Concept of preset & clear, Clocked-SR, JK, Master slave JK flip flop, T, D, Edge triggered and level triggered flip flops, Truth tables and excitation tables Registers, Shift registers, Bidirectional shift register, Ring counter, Twisted ring counter, Universal shift register			

Unit V	Sequential Logic Design	(08hrs)	COs Mapped - CO5
Counters: Types – Synchronous and asynchronous counters Asynchronous Counters: Modulus of the counter, Decade counter, Up, Down and Up/Down counters Synchronous sequential circuit design, State diagram, State assignment, State table, State reduction, Design procedure, Sequence generator and detector			
Text Books			
1. R. P. Jain, “Modern Digital Electronics”, Fourth Edition, Tata McGraw Hill, ISBN 978-0-07-06691-16 2. Moris Mano, “Digital Logic and Computer Design”, Second Edition, Pearson, ISBN: 978-8177584097			
Reference Books			
1. John Yarbrough, “Digital Logic applications and Design”, Fourth Edition, Thomson Publication, ISBN:978-8131500583 2. Malvino, D.Leach “Digital Principles and Applications”, Sixth Edition, Tata McGraw-Hill, ISBN: 978-0070601758			

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Quiz on Unit 1, Unit2, Unit 3 (Quiz 15 marks each and will be converted to 15 Marks)	15
2	Theory assignment on Unit 4, Unit 5 (One Assignment each on Unit 4 and Unit 5 of 10 marks will be converted to 5 Marks)	5
	Total	20



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: III COM222005:Programming Paradigms and Java Programming			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory :03 hrs/week		03	Continuous Comprehensive Evaluation: 20Marks InSem Exam: 20Marks EndSem Exam: 60Marks
Prerequisite Courses:-FYE221010:Programming in C, FYE221011:Programming in CPP			
Companion Course:- COM222009: Programming Paradigms and Computer Graphics Lab			
Course Objectives: <ul style="list-style-type: none">To understand principles of programming paradigmsTo learn Object Oriented Programming (OOP) principles in Java programmingTo be familiar with the basic concepts of logical and functional programming language			
Course Outcomes: On completion of the course, students will be able to–			
	Course Outcomes		Bloom’s Level
CO1	Remember and describe various programming paradigms		2-Understand
CO2	Make use of appropriate data types and control structures in Java to solve a given problem		3-Apply
CO3	Apply object oriented constructs in Java		3-Apply
CO4	Make use of exception handling and multithreading in Java		3-Apply
CO5	Compare and contrast Functional and Logic programming		4-Analyze
COURSE CONTENTS			
Unit I	Introduction to Programming Paradigms	(05hrs)	COs Mapped - CO1
Language standardization: Proprietary and consensus, Programming paradigms- Procedural, Object oriented, Functional, Logic Properties of data types, objects, Scalar data types, Composite data types, Programming language syntax, Stages in translation: analysis of the source program, synthesis of the object program.			
Unit II	Introduction to Java programming	(07hrs)	COs Mapped - CO2
History and features of Java, Java Virtual Machine Data Types: Signed vs. unsigned, User defined vs. primitive Data types, pointers Arrays: One dimensional array, Multi-dimensional array, Alternative array declaration statements Decision Making: if, else if, nested if, switch, Nested control structures: Syntax, semantics, pitfalls Iterative Control Structures: while, do-while, for, the „for- each”: Syntax, semantics, pitfalls Jump Statements :break and continue String Handling: String classes and methods. Comparison of Java and C++			

Unit III	Object Oriented Programming in Java	(08hrs)	COs Mapped - CO3
Classes and Methods: Review of object oriented programming, objects, classes. Assigning object reference variables, Introducing methods, constructors, Garbage collection, finalize() method Inheritance: Member access and inheritance, Super class references, Using „super“ to call super class constructor, Creating a multilevel hierarchy, Method overriding, Dynamic method - dispatch, Using abstract classes Packages and Interfaces: Defining a package, Finding packages, Access protection, Importing packages, Interfaces. Comparison of Java and C++			
Unit IV	Multithreading and Exception Handling using Java	(08hrs)	COs Mapped - CO4
Exception Handling: Types of Exceptions, Uncaught exceptions, Using try-catch, Multiple catch clauses, Nested try statements, Built-in exceptions, and Chained exceptions. Multithreading in Java: Thread priorities, Synchronization, Messaging, Main thread, Creating a thread, Creating multiple threads.			
Unit V	Logical and Functional Programming Languages	(08 hrs)	COs Mapped - CO5
LISP: Understanding symbol manipulation, Basic LISP functions, Definitions, predicates, Conditionals and scoping, Recursion and iteration, Properties list arrays and access functions, Using lambda definitions, Printing, Reading and atom manipulation Prolog: Introduction, Syntax and semantics of prolog programs, Lists, Operators, Arithmetic, Using structures.			
Text Books			
1. T. W. Pratt, M. V. Zelkowitz, "Programming Languages Design and Implementation", Fourth Edition, PHI, ISBN 81-203-2035-2 2. Herbert Schildt, "The Complete Reference Java", Ninth Edition, Tata McGraw Hill, ISBN: 978-0-07-180856-9 3. Ivan Bratko, "Prolog programming for Artificial Intelligence", Wesley publishers Limited, ISBN10: 0321417461 · ISBN13: 978-0321417466 4. Winston P., Klaus B., Horn P., "LISP", Third Edition Pearson education, ISBN:81-7808-155-5			
Reference Books			
1. Carlo Ghezzi, Mehdi Jazayeri, "Programming Language Concepts", Third Edition, Wiley Publication ISBN 978-81-265-1861-6. 2. Deugo, "Java Gems", Cambridge University Press, ISBN 0521648246			

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)	5
	Total	20



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S. Y. B. Tech. Computer Science and Design Pattern 2022 Semester: III COM222006: Design Thinking			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory : 01 hr/week		01	Term Work : 25 Marks
Prerequisite Courses:- FYE 221015:Engineering Exploration			
Course Objectives: <ul style="list-style-type: none">To understand concepts of design thinkingTo understand the different phases of design thinking			
Course Outcomes: On completion of the course, students will be able to–			
	Course Outcomes		Bloom’s Level
CO1	Explain stages and process of design thinking		2-Understand
CO2	Identify the methods to empathize and define the problem		2- Understand
CO3	Apply the ideation techniques for problem solving		3- Apply
CO4	Construct the prototype to evaluate a design		3- Apply
CO5	Apply testing techniques to improve the performance		3- Apply
COURSE CONTENTS			
Unit I	Overview of Design Thinking Process	(02 hrs)	COs Mapped - CO1
Introduction to Design Thinking - Definition, Ideas, Inventions, Innovations, Origin of design thinking, Importance of design thinking, Problem solving, Design thinking tools. Human-Centered Design (HCD) process - Empathize, Define, Ideate, Prototype and Test.			
Unit II	Empathy and Define	(02 hrs)	COs Mapped - CO2
Empathy - How to emphasize, Role of empathy in Design Thinking, Purpose of empathy maps, Things to be done prior to empathy mapping, Customer journey mapping. Define - How might we questions, The Five Whys Method.			
Unit III	Ideation	(02 hrs)	COs Mapped - CO3
Idea generation - Basic design directions, Themes of Thinking, Inspiration and references, Brainstorming, Value, Inclusion, Sketching, Presenting ideas, Refinement, Thinking in images, Thinking in signs, Appropriation, Humour, Personification, Visual metaphors.			
Unit IV	Prototype	(02 hrs)	COs Mapped - CO4
Prototyping - Assumptions during the design thinking process, Storyboards, Models and prototypes, Quick and Dirty Prototyping, Validation in the market, Best practices of presentation.			

Unit V	Testing and Implementation	(02 hrs)	COs Mapped - CO5
Test Phase – Technique for interviews and surveys, Kano Model, Desirability testing, Testing prototypes, Obtaining feedback to refine product usability Implementation - Efficiency and effectiveness of innovation and implementation strategies.			
Text Books			
1. Gavin Ambrose, Paul Harris “Design Thinking”, AVA Publishing (UK) Ltd, ISBN: 978-2-940411-17-7. 2. Christian Mueller Rotenberg, “Handbook of Design Thinking - Tips & Tools for how to Design Thinking”, 3. Tim Brown, Harper Collins, “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, Publication, ISBN: 9780061937743.			
Reference Books			
1. Idris Mootee, “Design Thinking for Strategic Innovation: What They Can’t Teach You at Business or Design School”, Wiley, ISBN: 978-1-118-62012-0 2. Jeanne Liedtka and Tim Ogilvie, “Designing for Growth: A Design Thinking Tool Kit for Managers”, Columbia University Press, ISBN: 0231158386, 9780231158381			
MOOC Course			
1.Design Thinking - A Primer: Prof. Bala Ramadurai - https://archive.nptel.ac.in/courses/110/106/110106124			

Guidelines for Term work Assessment
Term work Assessment shall be based on overall performance of a student. Rubrics for Assessment: R1- Multiple Choice Questions (Through ICT Tools / Paper work) (05) R2- Case Study Presentation (10) R3- Assignments/ Poster Presentation (10)



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: III COM222007: Data Structures Lab		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical : 04 hrs/week	02	Term Work: 25 Marks Practical Exam : 50 Marks
Prerequisite Courses:- FYE221010: Programming in C, FYE221011: Programming in CPP		
Companion Course:- COM222001: Fundamentals of Data Structures		
Course Objectives: <ul style="list-style-type: none"> To understand basic concepts and terminology of algorithms and data structures To study data structures arrays, linked lists, stack and queues To learn searching and sorting methods 		
Course Outcomes: On completion of the course, students will be able to–		
	Course Outcomes	Bloom's Level
CO1	Describe the fundamental concepts and terminology of data structures and algorithms, including arrays, linked lists, stacks, queues and searching and sorting algorithms	2-Understand
CO2	Demonstrate the ability to choose and implement appropriate data structures such as Array, linked list, stack and queue to solve a given problem	3-Apply
CO3	Implement algorithms for array and linked list processing such as insertion, and deletion using C++	3-Apply
CO4	Use stack and / or queue to solve the given problem	3-Apply
CO5	Compare different searching and sorting algorithms based on their performance, strengths, and limitations.	3-Apply

List of Laboratory Experiments / Assignments		
Sr. No.	Laboratory Experiments / Assignments	COs Mapped
1	Set operations: Write a menu driven C++ program to store sets for students' names participating in different events in Equinox such as Coding contest, Project competition, Paper Presentation, MasterMind etc. 1. Find out participants who have participated in Coding and Project both 2. Find out participants who have participated in Coding or Project competition or both or Mastermind 3. Find out participants who have participated in Coding but not in Master mind Find out participants who have participated in all events	CO1, CO2, CO3

2	<p>Knight's tour: The problem is to move the knight, beginning from any given square on the chessboard, in such a manner that it travels successively to all 64 squares, touching each square once and only once.</p> <p>It is convenient to represent a solution by placing the numbers 1,2, ...,64 in the squares of the chessboard indicating the order in which the squares are reached. Note that it is not required that the knight be able to reach the initial position by one more move; if this is possible the knight's tour is called re-entrant. One of the more ingenious methods for solving the problem of the knight's tour is that given by J. C. Warnsdorff in 1823. His rule is that the knight must always be moved to one of the squares from which there are the fewest exits to squares not already traversed. Write a C++ program to implement Warnsdorff's rule and show it graphically.</p> <p style="text-align: center;">OR</p> <p>Random walk: A (drunken) cockroach is placed on a given square in the middle of a tile floor in a rectangular room of size n x m tiles. The bug wanders (possibly in search of an aspirin) randomly from tile to tile throughout the room. Assuming that it may move from his present tile to any of the eight tiles surrounding it (unless it is against a wall) with equal probability, how long will it take him to touch every tile on the floor at least once?</p> <p>Write a C++ program to graphically show a random walk of a (drunken) cockroach and find the no of moves made.</p>	CO1,CO2, CO3
3	<p>String Operations: Write a menu driven C++ program with a class for String. Write functions</p> <ol style="list-style-type: none"> 1. To determine the frequency of occurrence of a particular character in the string. 2. Extract a new string from original string by accepting starting position and length 3. To accept any character and return the string with by removing all occurrences of a character accepted 4. To make an in-place replacement of a substring w of a string by the string x. Note that w may not be of same size that of x 5. To check whether given string is palindrome or not 	CO1,CO2, CO3
4	<p>Sparse Matrix: Write a menu driven C++ program with class for Sparse Matrix. Write functions to perform Sparse Matrix operations as listed below</p> <ol style="list-style-type: none"> 1. Read sparse matrix 2. Display sparse matrix 3. Add two sparse matrices 4. Find transpose using Simple transpose algorithm 5. Find transpose using Fast transpose algorithm <p>Compare complexity of simple and fast transpose using counter.</p>	CO1,CO2, CO3

5	<p>Polynomial operations: Write a menu driven C++ program with class for single variable polynomial and write functions to perform following polynomial operations using arrays</p> <ol style="list-style-type: none"> 1. Read polynomial 2. Display polynomial 3. Add two polynomials <p>You can try above polynomial operation using Linked list</p>	CO1,CO2, CO3
6	<p>Linked list operations: Create a linked list of names and birthdays of students. Write a menu driven C++ program to perform following operations</p> <ol style="list-style-type: none"> 1. Insert name and birthday of new student 2. Delete a student entry 3. Display a happy birthday message for whom today (based on system date) is birthday 4. Display list of students with their birthdays 	CO1,CO2, CO3
7	<p>Appointment Management: Write a menu driven C++ program for storing appointment schedules for the day. Appointments are booked randomly using linked lists. Set start and end time for visit slots. Write functions for</p> <ol style="list-style-type: none"> 1. Display free slots 2. Book appointment 3. Cancel appointment (check validity, time bounds, availability etc) 4. Sort list based on time 5. Sort list based on time using pointer manipulation 	CO1,CO2, CO3
8	<p>Expression conversion: Write a menu driven C++ program for expression conversion and evaluation</p> <ol style="list-style-type: none"> 1. infix to prefix 2. prefix to postfix 3. prefix to infix 4. postfix to infix 5. postfix to prefix 	CO1,CO2, CO4
9	<p>String operations: A palindrome is a string of characters that's identical when read in forward and backward direction. Typically, punctuation, capitalization, and spaces are ignored. For example, "1.Poor Dan is in a droop!!" is a palindrome, as can be seen by examining the characters "poordanisinadroop" and observing that they are identical when read forward and backward directions. One way to check for a palindrome is to reverse the characters in the string and compare them with the original-in a palindrome, the sequence will be identical.</p> <p>Write C++ program with functions using Standard Template Library (STL) stack-</p> <ol style="list-style-type: none"> 1. To print original string followed by reversed string using stack 2. To check whether given string is palindrome or not 	CO1,CO2, CO4
10	<p>Simulation of pizza parlor: Pizza parlor accepting maximum M orders. Orders are served on a first come first served basis. Order once placed cannot be canceled.</p> <p>Write C++ program to simulate the system using simple queue or circular queue</p>	CO1,CO2, CO4

11	<p>Sorting: Write a C++ menu driven program to store the percentage of marks obtained by the students in an array. Write function for sorting array of floating point numbers in ascending order using</p> <ol style="list-style-type: none"> 1. Selection Sort 2. Bubble sort 3. Insertion sort 4. Shell Sort 5. Quick sort 6. Radix sort 7. Display top five scores <p>Implement 4 methods of sorting. Provide choice to user to take input from user or using random numbers. Use Standard Template Library (STL) sort function for above data.</p>	CO1, CO5
12	<p>Searching: Write a C++ program to store roll numbers of students in an array who attended online lectures in random order. Write function for searching, whether a particular student attended lecture or not using</p> <ol style="list-style-type: none"> 1. Linear search 2. Binary search 3. Jump search <p>compare the searching methods based on complexities of an algorithm Provide choice to user to take input from user or using random numbers Use Visual C++ compiler to compile and execute the program.</p>	CO1, CO5
13	<p>A list of data representing various environmental parameters such as temperature, humidity, pollution levels, etc is maintained using appropriate data structure. Write a C++ program that uses data structures to perform the following operations:</p> <ol style="list-style-type: none"> 1. Find the maximum and minimum values of each parameter in the list. 2. Calculate the average value of each parameter in the list. 3. Sort the list in ascending order of any one parameter. 4. Find the highest and lowest values of any one parameter that are considered safe for the environment. 5. Calculate the impact of the parameter values on the environment based on certain pre-defined criteria. 6. Analyze the impact of the environmental parameters on the health and safety of the society. 7. Ensure that the program follows ethical and professional practices, such as ensuring the privacy and security of the data. <p>You should implement the program using appropriate data structures that take into account the size and complexity of the data, and demonstrate an understanding of the societal and environmental issues related to the data. Your program should also demonstrate an understanding of the impact of the parameter values on the environment, and the need for sustainable development. Finally, your program should adhere to ethical principles and professional practices, such as ensuring the confidentiality, privacy, and security of the data</p>	CO1, CO5

Mini Project		
	<p>Develop a mini project in a group Following is the sample problem statements based on concepts learned in the course</p> <p>1. Implement an efficient system to monitor and analyze sound pollution levels in a given area. The system should be able to store and process large amounts of sound data, and provide relevant insights and visualizations to help identify areas of high sound pollution.</p> <p>The system should have the following functionalities:</p> <ul style="list-style-type: none"> • Data Collection: Collected sound data from various sources, such as sound sensors or microphones is stored in a structured format as a file system. • Data Processing: The system should be able to process the collected data to identify patterns and trends in sound pollution levels. This could involve tasks such as noise filtering, signal processing, and feature extraction. • Data Analysis: The system should be able to analyze the processed data to provide insights into sound pollution levels in a given area. This could involve tasks such as trend analysis, outlier detection, and clustering. • Visualization: The system should be able to provide relevant visualizations to help identify areas of high sound pollution. This could involve tasks such as heat map generation, time-series plotting, and spatial analysis. <p>The system should be designed to handle large volumes of sound data efficiently and provide real-time or near-real-time analysis and visualization. The implementation of the system should be efficient in terms of space and time complexity, and should be scalable to handle increasing volumes of data.</p> <p>Students are free to implement any other relevant mini project problem statement as follows.</p> <p>2. Operations on Big number 3. Appointment management 4. Phone book operations 5. Sorting methods simulation and comparison</p>	CO1 to CO5
Additional programming problems for practice		
1	<p>Binary Number operations: Write a C++ menu driven program for storing binary numbers using doubly linked lists. Write functions-</p> <ol style="list-style-type: none"> 1. To compute 1's and 2's complement 2. Add two binary numbers 	CO1, CO2, CO3
2	<p>GLL: Write C++ program to realize set using generalized linked list e.g. A = { a, b, {c, d, e, {}}, {f, g}, h, i, {j, k}, l, m}. Store and print as set notation.</p>	CO1, CO2, CO3

3	Eight Queens: A classic problem that can be solved by backtracking is called the Eight Queens problem, which comes from the game of chess. The chess board consists of 64 squares arranged in an 8 by 8 grid. The board normally alternates between black and white squares, but this is not relevant for the present problem. The queen can move as far as she wants in any direction, as long as she follows a straight line, Vertically, horizontally, or diagonally. Write C++ program with a recursive function for generating all possible configurations for 8-queen's problem.	CO1, CO2, CO4
4	DEQUE: A double-ended queue (deque) is a linear list in which additions and deletions may be made at either end. Obtain a data representation mapping a deque into a one-dimensional array. Write C++ menu driven program to simulate deque with functions to add and delete elements from either end of the deque. Also implement using STL	CO1, CO2, CO4
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.		



S. Y. B. Tech. Computer Science and Design Pattern 2022 Semester: III COM222008: Digital Electronics Lab		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical : 02 hrs/week	01	Term Work: 25 Marks Practical Exam: 25 Marks
Prerequisite Courses:- FYE221007: Fundamentals of Electronics Engineering		
Companion Course:- COM222004: Digital Electronics and Logic Design		
Course Objectives: <ul style="list-style-type: none">• To study logic minimization techniques• To develop skills for design and implementation of combinational logic circuits• To develop skills for design and implementation of sequential logic circuits		
Course Outcomes: On completion of the course, students will be able to–		
	Course Outcomes	Bloom's Level
CO1	Solve the problem of minimization using K Map and Quine Mc-Clusky method of Boolean expression	3-Apply
CO2	Build combinational circuits using AND-OR logic	3-Apply
CO3	Build combinational circuits using SSI and MSI logic	3-Apply
CO4	Explain applications of Flip Flops, registers and shift registers	2-Understand
CO5	Develop sequential logic circuits using Flip Flops and MSI logic	3-Apply

List of Laboratory Experiments / Assignments		
Sr. No.	Laboratory Experiments / Assignments	COs Mapped
1.	To Realize Full Adder and Subtractor using logic gates	CO1,CO2
2.	Design and implement Code Converters-Binary to Gray and BCD to Excess-3	CO1,CO2
3.	Design and implement of BCD Adder using 4-bit Binary Adder (IC 7483)	CO1,CO2,CO3
4.	Realization of Boolean Expression using Multiplexer	CO3
5.	Design and implement two bit comparator using logic gates	CO1, CO2
6.	Design and implement Parity Generator and checker	CO1, CO2
7.	Realization of Boolean Expression using Encoder	CO3
8.	Realization of Boolean Expression using Decoder	CO3
9.	Implement 2 bit Ripple Counter using JK Flip Flop	CO4, CO5
10.	Design of Synchronous 2 bit Up/Down Counter using JK Flip Flop	CO1, CO4, CO5
11.	Design and implement Modulo-N counter using Decade Counter IC 7490	CO1, CO4,CO5
12.	Design and implement Sequence generator and detector using JK Flip Flop	CO1, CO4, CO5
13.	Implement 3/4 bits shift registers using D Flip Flop	CO4
Guidelines for Laboratory Conduction		

1. Teacher will brief the given experiment to students its procedure
2. Apparatus and equipments required for the allotted experiment will be provided by the lab assistants using SOP
3. Students will perform the allotted experiment in a group (three/four students in each group) under the supervision of faculty and lab assistant
4. After performing the experiment students will check their output from the teacher

Guidelines for Student's Lab Journal

Write-up should include title, aim, steps of circuit designing (Block Diagram, Truth Table, K Map, Expression, Realization, Conclusion)

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)



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: III COM222009: Programming Paradigms and Computer Graphics Lab		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical : 02 hrs/week	01	Term Work: 25Marks Practical Exam: 25Marks
Prerequisite Courses:- FYE221010:Programming in C, FYE221011: Programming in CPP, FYE221001: Applied Mathematics I		
Companion Course:- COM222005:Programming Paradigms and Java Programming, CSD222002:Computer Graphics		
Course Objectives: <ul style="list-style-type: none"> To understand object-oriented concepts in Java such as data abstraction, encapsulation, inheritance, dynamic binding, and polymorphism To be familiar with functional and logical programming paradigm To understand basic concepts of graphics Programming To know various algorithms for generating and rendering geometrical objects 		
Course Outcomes: On completion of the course, students will be able to–		
	Course Outcomes	Bloom's Level
CO1	Demonstrate Object Oriented Programming features like inheritance, data abstraction, encapsulation, and polymorphism to solve various computing problems	2 - Understand
CO2	Illustrate the use of exception handling and multithreading in Java	2 - Understand
CO3	Compare and contrast Functional and Logic programming	2 - Understand
CO4	Apply basic concepts of computer graphics to generate line, circle and polygon	3-Apply
CO5	Make use of algorithms for polygon filling and clipping	3-Apply
CO6	Apply geometric transformations on 2D objects	3-Apply
CO7	Develop graphical applications using Curves and Fractals	3-Apply

List of Laboratory Experiments / Assignments		
Sr. No.	Laboratory Experiments / Assignments	COs Mapped
1	Write a JAVA program to create a base class “Person” with name and phone number as its attributes. Derive a class “Academic Performance” with Degree and percentage as its attributes from the “Person” class. Display both personal and academic information. Make use of constructor, default constructor, copy constructor and a destructor. Also Derive a class “Sports performance” with sports-name and score as its attribute from the “Person” class. Display personal data along with information about scores obtained in the Sport event.	CO1
2	A publishing company deals with marketing of books and audio cassettes. For each book and the audio cassette the company needs to record a title and price of publication. Also a page count should be recorded for each book and a play-time in minutes should be recorded for each cassette. Design a suitable class hierarchy. Write a menu driven program that instantiates the book and tape class, allows users to manipulate and display	CO1

	the information about books and cassettes. The program should catch exceptions and if an exception is caught, it should replace all the values of data members with zeroes.	
3	Write a JAVA program to create User defined exception to check the following conditions and throw the exception if the criterion does not met. a. User has age between 18 and 55 b. User stays has income between Rs. 50,000 – Rs. 1,00,000 per month c. User stays in Pune / Mumbai/ Bangalore / Chennai d. User has 4-wheeler Accept age, Income, City, Vehicle from the user and check for the conditions mentioned above. If any of the condition not met then throw the exception.	CO2
4	Write java program to create a super class called Figure that receives the dimensions of two dimensional objects. It also defines a method called area that computes the area of an object. The program derives two subclasses from Figure. The first is Rectangle and second is Triangle. Each of the sub class overridden area() so that it returns the area of a rectangle and a triangle respectively	CO1
5	Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication	CO2
6	Consider a database of facts that describe parent relationships as well as gender relationships. The predicate parent (john,ann) is interpreted as: "John is a parent of Ann". The predicate male (john) is interpreted as: "John is a man". The predicate female (ann) is interpreted as: "Ann is a woman". Write a Prolog predicate halvesister (X,Y) that is true if X is Y's half-sister.	CO3
7	Declare a global constant PI and later using this value calculates the area of a circle using LISP.	CO3
8	Write a C++ program to draw the given pattern. Use DDA Line and Bresenham's Circle drawing algorithm.	CO4
9	Write a C++ program to draw a polygon and fill it with desired color using scan fill algorithm.	CO5
10	Write a C++ program to implement Cohen-Sutherland line clipping algorithm for a given window.	CO5
11	Write a menu driven C++ program to draw 2-D object and perform following transformations, a) Scaling b) Translation c) Rotation.	CO6
12	Write a C++ program to generate fractal patterns using Koch Curve	CO7
Guidelines for Laboratory Conduction		
Use of open source software is encouraged. Operating System recommended :- 64-bit Open source Linux or its derivative Programming tools recommended: - Open Source Java Programming tool Students shall use popular Java compilers/IDE such as GNU/Javac/Eclipse/Rose/SmartEiffel		
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, Objectives, Problem Statement, Software and Hardware requirements, Theory- Concept in brief, algorithm, flowchart, mathematical model (if applicable) and conclusions. Program codes with sample output of all performed assignments are to be submitted as softcopy.		
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)



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: III COM222010: Python Programming Lab		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical : 2 hrs/week	01	Term Work : 25 Marks
Prerequisite Courses:- FYE221010: Programming in C, FYE221011: Programming in CPP		
Course Objectives: <ul style="list-style-type: none">To understand core python programmingTo understand python looping, control statements and string manipulationsTo understand the basic concepts of functions		
Course Outcomes: On completion of the course, students will be able to–		
	Course Outcomes	Bloom's Level
CO1	Use the core concepts to write a python program	3-Apply
CO2	Apply control structure and loops to build a solution for a given problem	3-Apply
CO3	Develop python program for string manipulation	3-Apply
CO4	Build a solution for a given problem using lists, sets, tuples, dictionaries	3-Apply
CO5	Develop programs using functions	3-Apply
COURSE CONTENTS		
Installation of Python IDEs: PyCharm/Eclipse/PyDev Data-types in Python Variables in Python Identifiers, Data Types, Constants, Input / Output, Operators (Arithmetic, relational, logical, bitwise), Expressions, Precedence and Associativity, Type conversions Taking User Input (Console) Conditional algorithmic constructs: if, if-else, nested if-else, cascaded if-else and switch statement Iterative algorithmic constructs: „for“, „while“ statements, nested loops, Continue, break statements Function: definition, call, variable scope and lifetime, the return statement. Defining functions, Lambda or anonymous function Arrays: One- dimensional, multidimensional array, character arrays (Strings).		

List of Laboratory Experiments / Assignments		
Sr. No.	Laboratory Experiments / Assignments	CO Mapped
1	<p>Write a python program that accepts seconds as input of type integer. The program should convert seconds in hours, minutes and seconds. Output should like this :</p> <p>Enter seconds: 12200 Hours: 3 Minutes: 23 Seconds: 20</p>	CO1
2	<p>Conditional Structures The marks obtained by a student in 3 different subjects are input by the user. Python program should calculate the average marks obtained in 3 subjects and display the grade. The student gets a grade as per the following rules:</p> <p>Average Grade 90-100 O 80-89 A 70-79 B 60-69 C 40-59 D 0-39 F</p>	CO2
3	<p>Control structures Floyd's triangle is a right-angled triangular array of natural numbers as shown below:</p> <pre>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15</pre> <p>Write a python program to print the Floyd's triangle</p>	CO2
4	<p>String Write a python program that accepts a string to setup a password with following requirements:</p> <ul style="list-style-type: none"> • The password must be at least eight characters long • It must contain at least one uppercase letter • It must contain at least one lowercase letter • It must contain at least one numeric digit <p>The program checks the validity of password.</p>	CO3
5	<p>List Write a python program to</p> <ul style="list-style-type: none"> • Find the sum and average of given numbers using lists • Display elements of list in reverse order • Find the minimum and maximum elements in the lists 	CO4
6	<p>Tuple Write a Python program to sort a tuple by its float element. Sample data: [('item1', '13.10'), ('item2', '17.10'), ('item3', '25.3')] Expected Output: [('item3', '25.3'), ('item2', '17.10'), ('item1', '13.10')]</p>	CO4

7	Dictionary Write a python program to read string from user and create a dictionary having key as word length and value is count of words of that length. For example, if user enters „I scream you scream we all scream for ice cream“ <table><tr><td>Word</td><td>Word length</td></tr><tr><td>I</td><td>1</td></tr><tr><td>scream</td><td>6</td></tr><tr><td>you</td><td>3</td></tr><tr><td>scream</td><td>6</td></tr><tr><td>we</td><td>2</td></tr><tr><td>all</td><td>3</td></tr><tr><td>scream</td><td>6</td></tr><tr><td>for</td><td>3</td></tr><tr><td>ice</td><td>3</td></tr><tr><td>cream</td><td>5</td></tr></table> The content of dictionary should be {1:1, 6:3, 3:4, 2:1, 5:1}	Word	Word length	I	1	scream	6	you	3	scream	6	we	2	all	3	scream	6	for	3	ice	3	cream	5	CO4
Word	Word length																							
I	1																							
scream	6																							
you	3																							
scream	6																							
we	2																							
all	3																							
scream	6																							
for	3																							
ice	3																							
cream	5																							
8	Set Write a python program for operations on set	CO4																						
9	Function Write a function in python to display the elements of list thrice if it is a number and display the element terminated with „#“ if it is not a number. Suppose the following input is supplied to the program: [„23“ „„MAN“ „„GIRIRAJ“ „„24“ „„ZARA“] The output should be 232323 MAN# GIRIRAJ# 242424 ZARA#	CO5																						
Mini Project																								
10	Develop a mini project in a group based on Python programming concepts and design thinking	CO1 to CO5																						
Guidelines for Laboratory Conduction																								
Use of coding standards and Hungarian notation, proper indentation and comments. Operating System recommended:- Linux or its derivative Use the concepts of design thinking in mini project.																								
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) R3- Use Coding standards, proper documentation, neatness of writeup (10) – 5 marks for coding standards and documentation and 5 marks for neatness of write up																								

Text Books	
1.	Reema Thareja, “Python Programming Using Problem Solving Approach”, Oxford University Press, ISBN 13: 978-0-19-948017-6 2.
2.	R. Nageswara Rao, “Core Python Programming”, Dreamtech Press, ISBN-13: 978-9386052308
Reference Books	
1.	R. G. Dromey, “How to Solve it by Computer”, Pearson Education India, ISBN-13: 978-8131705629
2.	Maureen Spankle, “Problem Solving and Programming Concepts”, Pearson, ISBN-13: 978-0132492645



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 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, by peter V.O "Neil (Thomson Learning) 4. Introduction to Probability and Statistics for Engineers and Scientists, 5e, by Sheldon M. Ross (Elsevier Academic Press)			
ReferenceBooks			
1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Eastern Ltd. 2. P.N.Wartikar and J.N.Wartikar, "Applied Mathematics" (Volumes I and II), Pune Vidyarthi Griha Prakashan, Pune. 3. AdvancedEngineeringMathematics, 2e, by M.D.Greenberg (Pearson Education).			

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr.No.	Components for Continuous Comprehensive Evaluation	Marks Alloted
1	Assignments (Total 3 Assignment, Unit I and II 20marks, Unit III and IV 20marks and Unit V - 10marks & 50marks will be converted to 10 Marks)	10
2	Tests on each unit using Learn iCo (Each test for 15 Marks and total will be converted out of 10 Marks)	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
(Autonomous from Academic Year 2022-23)

S. Y. B. Tech. Computer Science and Design Pattern 2022 Semester: IV COM222012: 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:- COM222001: Fundamentals of Data structures, COM222003:Discrete Mathematics			
Companion Course:- COM222017: Advanced Data Structures Lab			
Course Objectives: <ul style="list-style-type: none">To understand basic concepts of non linear data structures such as trees, graphsTo study the concepts of hash table and filesTo 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, Converting 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



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 COM222013 : 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:- COM222001:Fundamentals of data structures			
Companion Course:- COM222018: Operating Systems Lab			
Course Objectives: <ul style="list-style-type: none">• 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. Operating system operations: Dual 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: - COM222004:Digital Electronics and Logic Design			
Companion Course :- CSD222019: Computer Networks Lab			
Course Objectives: <ul style="list-style-type: none">To understand fundamental concepts of networking standards, protocols, hardware and technologiesTo understand the basics of error detection including parity, checksums, and CRCTo understand the client/server model and key application layer protocolsTo learn sockets programming and how to implement client/server applicationsTo 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



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 COM222015: 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:-COM222001:Fundamentals of Data Structures, COM222005:Programming Paradigms and Java Programming			
Course Objectives: <ul style="list-style-type: none">To understand the need for the software life cycle and its implicationsTo be acquainted with methods of capturing, specifying, visualizing and analyzing software requirementsTo 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 W³HH Principle

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



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 COM222016: MOOC – Client Side Technology		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory: MOOC	01	
Prerequisite Courses:- COM222006: Design Thinking		
Companion Course:- COM222020: Project Based Learning –Client Side Technology		
Course Objectives: <ul style="list-style-type: none"> 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			



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S. Y. B. Tech. Computer Science and Design Pattern 2022 Semester: IV COM222017: 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:- COM222001: Fundamentals of Data structures, COM222003: Discrete Mathematics		
Companion Course: COM222012: Advanced Data Structures		
Course Objectives: <ul style="list-style-type: none"> 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 its 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	<p>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.</p>	CO3, CO5
11	<p>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.</p>	CO3, CO5
12	<p>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</p>	CO4, CO5
13	<p>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</p> <ol style="list-style-type: none"> 1. BST 2. AVL 3. User defined Hash table 4. STL Map 5. Hashmap in Java <p>Use Visual C++ and Java Compiler</p>	CO1, CO2, CO3, CO5
14	<p>Study Assignment:</p> <ol style="list-style-type: none"> 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. <p>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.</p> <p>Some specific challenges that data structures in social media applications must address include:</p> <ul style="list-style-type: none"> • 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 $k = k_1 < k_2 < \dots < k_n$ of n sorted keys, with a search probability p_i for each key k_i . 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.



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 COM222018: Operating Systems Laboratory		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical : 02 hrs/week	01	Term Work: 25 Marks Practical Exam : 25 Marks
Prerequisite Courses:- COM222001: Fundamentals of Data Structures		
Companion Course:- COM222013: Operating Systems		
Course Objectives: <ul style="list-style-type: none"> 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	<p>Execute following AWK operations on the text file :</p> <ol style="list-style-type: none"> 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		
<p>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++</p>		
Guidelines for Student's Lab Journal		
<p>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.</p>		
Guidelines for Term work Assessment		
<p>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).</p>		



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: - COM222004: Digital Electronics and Logic Design		
Companion Course:- CSD222014: Computer Networks		
Course Objectives: <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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

	<ul style="list-style-type: none"> • simple topology • complex topology 3 Wireshark <ul style="list-style-type: none"> • 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		
<ul style="list-style-type: none"> • 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		
<ul style="list-style-type: none"> • 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		
<ol style="list-style-type: none"> 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. 		



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 COM222020: Project Based Learning –Client Side Technology		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical : 02 hrs/week	01	Term Work : 25 Marks
Prerequisite Courses :- COM222006: Design Thinking		
Companion Course:- COM222016: Client Side Technology		
Course Objectives: <ul style="list-style-type: none"> 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	10 M
Task 2 : Ideation	
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)	