K.K. Wagh Institute of Engineering Education and Research, Nashik

Curriculum

B.Tech

Computer Engineering

2022 Pattern

w.e.f.: AY 2022-2023

● **Summary of Credits and Total Marks for Under Graduate (UG) Programme:**

Class	Semester	Total Credits	Total Marks
FY BTECH	**I**	**20**	**675**
	II	**22**	**825**
SY BTECH	**III**	**21**	**725**
	IV	**21**	**725**
TY BTECH	**V**	**22**	**750**
	VI	**22**	**750**
FINAL BTECH	**VII**	**22**	**750**
	VIII	**20**	**700**
Total		**170**	**5900**

● **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 /Audit Courses	**ASM**	Additional Specialized / MOOCs

F.Y. B. Tech Computer Engineering wef AY 2022-23

SEM-I

Course Code	Course Type	Title of Course	Teaching Scheme Hrs./week			Assessment Scheme and Marks						Credits			
			TH	TU	PR	In Sem	End Sem	CA	TU/ TW	PR/ OR	Total	TH	TU / TW	PR/ OR	Total
FYE221001	BSC	Applied Mathematics – I	4	1	0	20	60	20	25	0	125	4	1	0	5
FYE221005	BSC	Applied Chemistry	3	0	2	20	60	20	50	0	150	3	1	0	4
FYE221006	ESC	Fundamentals of Electrical Engineering	3	0	2	20	60	20	50	0	150	3	1	0	4
FYE221010	ESC	Computational Thinking and C Programming	2	0	2	25	50	0	50	0	125	2	1	0	3
FYE221013	ESC	Workshop Practice	0	0	2	0	0	0	50	0	50	0	1	0	1
FYE221014	LHSM	Communication Skills	1	0	2	0	0	25	50	0	75	1	1	0	2
		Total	**13**	**1**	**10**	**85**	**230**	**85**	**275**	**0**	**675**	**13**	**6**	**0**	**19**

F.Y. B. Tech Computer Engineering wef AY 2022-23

SEM-II

Course Code	Course Type	Title of Course	Teaching Scheme Hrs./week			Assessment Scheme and Marks						Credits			
			TH	TU	PR	In Sem	End Sem	CA	TU/ TW	PR/ OR	Total	TH	TU / TW	PR/ OR	Total
FYE221002	BSC	Applied Mathematics – II	4	1	0	20	60	20	25	0	125	4	1	0	5
FYE221003	BSC	Applied and Modern Physics (A)	3	0	2	20	60	20	50	0	150	3	1	0	4
FYE221007	ESC	Fundamentals of Electronics Engineering	3	0	2	20	60	20	50	0	150	3	1	0	4
FYE221011	ESC	Programming in C++	3	0	2	25	50	0	50	0	125	3	1	0	4
FYE221012	ESC	Engineering Drawing	1	1	2	25	50	0	50	0	125	1	2	0	3
FYE221015	PSI	Engineering Explorations	0	0	2	0	0	0	100	0	100	0	1	0	1
FYE221016	LHSM	Democracy, Election and Governance	2	0	0	25	25	0	0	0	50	2	0	0	2
		Total	**16**	**2**	**10**	**135**	**305**	**60**	**325**	**0**	**825**	**16**	**7**	**0**	**23**

S.Y. B. Tech Computer Engineering wef AY 2023-24																	
SEM-III																	
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

***Credit for PR head are linked with PR/OR/TW/TU**

#This credit will be assessed as TW

S.Y. B. Tech Computer Engineering wef AY 2023-24																	
SEM-IV																	
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
COM222014	DCC	Computer Architecture	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
COM222019	DCC	Microprocessors 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**

T.Y. B. Tech wef AY 2024-25															
SEM-V															
Course Code	**Course Type**	**Title of Course**	**Teaching Scheme**			**Evaluation Scheme and Marks**						**Credits**			
			TH	**TU**	**PR**	**INSEM**	**ENDSEM**	**CCE**	**TUT /TW**	**PR /OR**	**TOTAL**	**TH**	**TU**	**PR**	**TOTAL**
COM223001	DCC	Design and Analysis of Algorithm	3	-	-	20	60	20			100	3	-	-	3
ADS223002	DCC	Artificial Intelligence	3	-	-	20	60	20			100	3	-	-	3
COM223003	DCC	Database Management Systems	3	-	-	20	60	20			100	3	-	-	3
COM223004	DCC	Database Management Systems Lab	-	-	2	-	-	-	25	25	50	-	-	1	1
COM223005	DCC	Design and Analysis of Algorithm Lab	-	-	2				25	25	50	-	-	1	1
COM223006	DEC	Department Elective Course I	3	-	-	20	60	20			100	3	-	-	3
COM223007	DEC	Department Elective Course I Lab	-	-	2	-	-	-	25	25	50	-	-	1	1
COM223008	OEC	Management Information System	2	-	-	-	-	50	-	-	50	2	-	-	2
COM223009	ESC	Data Communications & Networking	3	-	-	20	60	20	-	-	100	3	-	-	3
COM223010	PSI	Project Based Learning	-	1	2	-	-	-	TUT-25 TW-25	-	050	-	1	1	2
Total			**17**	**01**	**08**	**100**	**300**	**150**	**125**	**75**	**750**	**17**	**1**	**4**	**22**

T.Y. B. Tech wef AY 2024-25															
SEM-VI															
Course Code	**Course Type**	**Title of Course**	**Teaching Scheme**			**Evaluation Scheme and Marks**						**Credits**			
			TH	**TU**	**PR**	**INSEM**	**ENDSEM**	**CCE**	**TUT /TW**	**PR /OR**	**TOTAL**	**TH**	**TU**	**PR**	**TOTAL**
COM223011	DCC	Data Science and Big Data	3	-	-	20	60	20			100	3	-	-	3
COM223012	DCC	Theory of Computation	3	-	-	20	60	20			100	3	-	-	3
COM223013	DCC	Data Science and Big data Lab	-	-	2	-	-	-	25	25	50	-	-	1	1
COM223014	DEC	Department Elective Course II	3	-	-	20	60	20			100	3	-	-	3
COM223015	DEC	Department Elective Course III	3	-	-	20	60	20	-	-	100	3	-	-	3
COM223016	DEC	Department Elective Course II + Department Elective Course III Lab	-	-	2	-	-	-	25	25	50	-	-	1	1
COM223017	ESC	Microcontrollers and Embedded Systems	3	-	-	20	60	20			100	3	-	-	3
COM223018	OEC	Intellectual Property Rights	2	-	-	-	-	50	-	-	50	2	-	-	2
COM223019	ASM	Mobile Application Development	-	1	2				25	25	50	-	1	1	2
COM223020	PSI	Seminar	-	-	2	-	-	-	50	-	50	-	-	1	1
Total			**17**	**01**	**08**	**100**	**300**	**150**	**125**	**75**	**750**	**17**	**1**	**4**	**22**

Department Elective Courses

Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TUT /TW	PR /OR	TOTAL	TH	TU	PR	TOTAL
Department Elective Course I (Sem-V) (Student have to choose any one of the following)															
COM223006A	DEC	Internet of Things	3	-	-	20	60	20	-	-	100	3	-	-	3
COM223006B		Augmented Reality and Virtual Reality													
COM223006C		Software Testing and Quality Assurance													
Department Elective Course I Lab (Sem-V) (Student have to choose lab based on selected Program Elective Course I)															
COM223007A	DEC	Internet of Things Lab	-	-	2	-	-	-	25	25	50	-	-	1	1
COM223007B		Augmented Reality and Virtual Reality Lab													
COM223007C		Software Testing and Quality Assurance Lab													
Department Elective Course II (Sem-VI) (Student have to choose any one of the following)															
COM223014A	DEC	User Interface and User Experience	3	-	-	20	60	20	-	-	100	3	-	-	3
COM223014B		Generative AI and Prompt Engineering													
COM223014C		High Performance Databases													
Department Elective Course III (Sem-VI) (Student have to choose lab based on selected Program Elective Course II)															
COM223015A	DEC	Cloud computing	3	-	-	20	60	20	-	-	100	3	-	-	3
COM223015B		Natural Language Processing													
COM223015C		High Performance Computing													
Department Elective Course II + Program Elective Course Lab III Lab (Sem-VI) (Lab based on chosen elective course II and III by students)															
COM223016	DEC	Program Elective Course II + Program Elective Course Lab III Lab	-	-	2	-	-	-	25	25	50	-	-	1	1

Final year B. Tech wef AY 2025-26															
SEM-VII															
Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TUT /TW	PR /OR	TOTAL	TH	TU	PR	TOTAL
COM224001	DCC	Deep Learning	3	-	-	20	60	20			100	3	-	-	3
COM224002	DCC	Cyber Security	3	-	-	20	60	20			100	3	-	-	3
COM224003	DCC	Deep Learning Lab	-	-	2	-	-	-	25	25	50	-	-	1	1
COM224004	DCC	Cyber Security Lab	-	-	2	-	-	-	25	25	50	-	-	1	1
COM224005	DEC	Department Elective Course IV	3	-	-	20	60	20	-	-	100	3	-	-	3
COM224006	DEC	Department Elective Course V	2	-	-	20	30	-	-	-	50	2	-	-	2
COM224007	ASM	Research Methodology	3	-	-	20	60	20	-	-	100	3	-	-	3
COM224008	LHSM	Banking, Financial Services and Insurance	2	-	-	-	-	50	-	-	50	2	-	-	2
COM224009	PSI	Project Work	-	-	8	-	-	-	100	50	150	-	-	4	4
Total			**16**	**00**	**12**	**100**	**270**	**130**	**150**	**100**	**750**	**16**	**-**	**6**	**22**

Final year B. Tech wef AY 2025-26															
SEM-VIII															
Course Code	**Course Type**	**Title of Course**	**Teaching Scheme**			**Evaluation Scheme and Marks**						**Credits**			
			TH	**TU**	**PR**	**INSEM**	**ENDSEM**	**CCE**	**TUT /TW**	**PR /OR**	**TOTAL**	**TH**	**TU**	**PR**	**TOTAL**
COM224011	DCC*	Software Architecture and Design Patterns	3	-	-	-	100	-			100	3	-	-	3
COM224012	DEC*	Department Elective Course VI	3	-	-	-	100	-	-	-	100	3	-	-	3
COM224013	LHSM	Digital Marketing	2	-	-	-	-	50	-	-	50	2	-	-	2
COM224014	PSI	Internship	-	-	24	-	-	-	300	150	450	-	-	12	12
Total			**08**	**00**	**24**	**-**	**200**	**50**	**300**	**150**	**700**	**08**	**-**	**12**	**20**

* Considering Internship of 6 months, these courses to be offered in online mode

Department Elective Courses

Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TUT /TW	PR /OR	TOTAL	TH	TU	PR	TOTAL
Department Elective Course IV (Sem-VII) (Student have to choose any one of the following)															
COM224005A	DEC	Computer Vision	3	-	-	20	60	20	-	-	100	3	-	-	3
COM224005B		Information Retrieval													
COM224005C		Business Intelligence and Analytics													
Department Elective Course V (Sem-VII) (Student have to choose any one of the following)															
COM224006A	DEC	Operation Research	2	-	-	20	30	-	-	-	50	2	-	-	2
COM224006B		Unix Internals													
COM224006C		Compiler Design													
Department Elective Course VI (Sem-VIII) (Student have to choose any one of the following)															
COM224012A	DEC	Blockchain	3	-	-	-	100	-	-	-	100	3	-	-	3
COM224012B		Bioinformatics													
COM224012C		Digital Forensic													

B. Tech (Program) Honors/Minor* in Computer Network

Sem	Course Code	Couse Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
				TH	TU	PR	INSEM	ENDSEM	CCE	TUT /TW	PR /OR	TOTAL	TH	TU	PR	TOTAL
VI	COM223021	DCC	Network Protocols and Algorithms	04	-	-	20	60	20	-	-	100	04	-	-	04
	COM223022	DCC	Network Protocols and Algorithms Lab	-	-	04	-	-	-	50	50	100	-	-	02	02
VII	COM224021	DCC	Cloud Infrastructure	04	-	-	20	60	20	-	-	100	04	-	-	04
	COM224022	DCC	Cloud Infrastructure Lab	-	-	04	-	-	-	50	50	100	-	-	02	02
VIII	COM224023	DCC	Wireless Sensor Network	03	-	-	20	60	20	-	-	100	03	-	-	03
	COM22404	DCC	Software Defined Network	03	-	-	20	60	20	-	-	100	03	-	-	03
	Total			**14**	**-**	**08**	**80**	**240**	**80**	**100**	**100**	**600**	**14**	**-**	**04**	**18**

*It will be offered as honors degree for Computer Engineering/Artificial Intelligence and Data Science Engineering/Computer Science and Design Engineering/Information Technology programs and is offered as minor degree for other programs

B. Tech (Program) Honors/Minor* in Databases																
Sem	**Course Code**	**Couse Type**	**Title of Course**	**Teaching Scheme**			**Evaluation Scheme and Marks**						**Credits**			
				TH	**TU**	**PR**	**INSEM**	**ENDSEM**	**CCE**	**TUT /TW**	**PR /OR**	**TOTAL**	**TH**	**TU**	**PR**	**TOTAL**
VI	COM223023	DCC	Relational Database and SQL	04	-	-	20	60	20	-	-	100	04	-	-	04
	COM223024	DCC	Relational Database and SQL Lab	-	-	04	-	-	-	50	50	100	-	-	02	02
VII	COM224025	DCC	Modern Database System	04	-	-	20	60	20	-	-	100	04	-	-	04
	COM224026	DCC	Modern Database System Lab	-	-	04	-	-	-	50	50	100	-	-	02	02
VIII	COM224027	DCC	Query Processing and Optimization	03	-	-	20	60	20	-	-	100	03	-	-	03
	COM224028	DCC	Parallel and Distributed Database System	03	-	-	20	60	20	-	-	100	03	-	-	03
	Total			**14**	**-**	**08**	**80**	**240**	**80**	**100**	**100**	**600**	**14**	**-**	**04**	**18**

*It will be offered as honors degree for Computer Engineering/Artificial Intelligence and Data Science Engineering/Computer Science and Design Engineering/Information Technology programs and is offered as minor degree for other programs

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

T. Y. B. Tech. Computer Engineering
Pattern 2022 Semester: V
COM223001: Design and Analysis of Algorithms

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
COM222012: Advanced Data Structures

Companion Course :- COM223005:Design and Analysis of Algorithms Lab

Course Objectives:

- To study and perform analysis of algorithms
- To study how to solve problems using greedy strategy
- To study how to solve problems using dynamic programming.
- To study how to solve problems using backtracking and branch-n-bound strategies
- To understand computational complexity theory.

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

	Course Outcomes	Bloom's Level
CO1	Design and analyze algorithms	4-Analyze
CO2	Solve problems using greedy strategy	3-Apply
CO3	Solve problems using dynamic programming strategy	3-Apply
CO4	Solve problems using backtracking and branch-n-bound strategies	3-Apply
CO5	Apply computational complexity theory	3-Apply

COURSE CONTENTS

Unit I	**Problem Solving and Basics of Algorithmic Analysis**	**(06 hrs)**	**CO1**

Problem solving principles: Classification of problem, problem solving strategies, What are algorithms, classification of time complexities (linear, logarithmic etc), Divide and Conquer strategy. Asymptotic notations, Best case, worst case, average case analysis, lower bound and upper bound, amortized analysis. Recurrences: Formulation and solving recurrence equations using Master Theorem

Unit II	**Greedy Strategy**	**(08 hrs)**	**CO2**

Principle, control abstraction, time analysis of control abstraction, knapsack problem, scheduling algorithms-Job scheduling and activity selection problems

Unit III	**Dynamic Programming**	**(08hrs)**	**CO3**

Principle, control abstraction, time analysis of control abstraction, binomial coefficients, OBST, 0/1 knapsack, Chain Matrix Multiplication.

Unit IV	**Backtracking and Branch -and-Bound**	**(08hrs)**	**CO4**

Backtracking: Principle, control abstraction, time analysis of control abstraction, 8-queen problem, graph coloring problem, sum of subsets problem. Branch-and-Bound: Principle, control abstraction, time

analysis of control abstraction, strategies: FIFO, LIFO and LC approaches. TSP, knapsack problem.			
Unit V	**Complexity Theory**	**(06hrs)**	**CO5**
Polynomial and non-polynomial problems, deterministic and non-deterministic algorithms, P class, NP class &NP complete problems- vertex cover and 3-SAT and NP-Hard Problems: Hamiltonian cycle problem, Clique problem.			
Text Books			
1. Horowitz and Sahani, "Fundamentals of Computer Algorithms", Second edition, University Press, ISBN: 978-8173716126 2. Gills Brassard and Paul Bartly, "Fundamentals of Algorithmic", PHI New Delhi. 3. Aho, Hopcroft, Ullman, "The Design and Analysis of Computer Algorithms", Pearson Education, New Delhi, 2003			
Reference Books			
1. Fayez Gebali, "Algorithms and Parallel Computing",Willy, ISBN 978-0470902103 2. Thomas H. Coreman and Charles R. L. Leiserson, "Introduction to Algorithm", PHI New Delhi			

Strength of CO-PO PSO Mapping														
	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	2	2	2	2	2	-	-	-	2	3	2
CO2	2	2	2	2	2	2	2	2	-	-	-	2	3	2
CO3	2	2	2	2	2	2	2	2	-	-	-	2	3	2
CO4	2	2	2	2	2	2	2	2	-	-	-	2	3	2
CO5	2	2	2	2	2	2	2	2	-	-	-	2	3	2
Average	2	2	2	2	2	2	2	2	-	-	-	2	3	2

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 , Unit-4, Unit-5 each of 10 marks (Total marks will be converted to 20 out of 50)	20
	Total	**20**

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

T. Y. B. Tech Computer Engineering Pattern 2022 Semester: V ADS223002: Artificial Intelligence		
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, COM222012: Advanced Data Structures, COM223001: Design and Analysis of Algorithm.

Companion Course:- -

Course Objectives:

- To study the concept of Artificial Intelligence
- To illustrate problem solving using search strategies for AI
- To learn adversarial search methods for AI
- To get acquainted with the fundamentals of logical reasoning related to AI
- To get familiar with the fundamentals of knowledge representation in AI

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

	Course Outcomes	**Bloom's Level**
CO1	Identify Intelligent agents for various AI applications	3-Apply
CO2	Illustrate different informed search / uninformed search or heuristic approaches for AI	2-Understand
CO3	Identify adversarial search methods for AI	3-Apply
CO4	Relate reasoning for making AI enabled systems	2-Understand
CO5	Make use of knowledge representation for AI systems	2-Understand

COURSE CONTENTS

Unit I	**Introduction of Artificial Intelligence**	**(06 hrs)**	**CO1**

Foundations of Artificial Intelligence, History of Artificial Intelligence, State of the Art, Risks and Benefits of AI, Agents and Environments, Intelligent Agents, Typical Intelligent Agents, Problem Solving Approach to Typical AI problems.

Unit II	**Problem Solving using Search Techniques**	**(08 hrs)**	**CO2**

Problem solving agents, Searching for solutions, Uniform search strategies, Breadth first search, Depth first search, Depth limited search, Bidirectional search, Heuristic search strategies, Greedy best -first search, A* search, Memory bounded heuristic search, Local search algorithms & optimization problems, Hill climbing search, Simulated Annealing.

Unit III	**Adversarial search**	**(08hrs)**	**CO3**

Games, Optimal Decisions in Games, Alpha-beta pruning. Constraint Satisfaction Problems (CSP), Defining CSP, Constraint Propagation, Inference in CSP, Backtracking Search for CSPs, Local Search for CSPs.

Unit IV	**Logical Reasoning**	**(08hrs)**	**CO4**

Knowledge-based agents, Propositional Logic, First-order logic, syntax and semantics, knowledge representation and engineering, inferences in first-order logic, forward chaining, backward chaining, resolution.

Unit V	**Knowledge Representation**	**(06hrs)**	**CO5**

Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects. Case study of The Internet Shopping World.

Text Books

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", 4th Edition, University of California at Berkeley, Pearson education, 2020.
2. Vinod Chandra, A. Hareendran, Artificial Intelligence- principles and applications, PHI, Second Edition, 2021.

Reference Books

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2008
2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
3. I. Bratko, "Prolog: Programming for Artificial Intelligence", Fourth Edition, Addison-Wesley Educational Publishers Inc., 2011

Strength of CO-PO / PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	2	2
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	2	2
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**

Guidelines for Continuous Comprehensive Evaluation of Theory Course

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

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

T. Y. B. Tech. Computer Engineering
Pattern 2022 Semester: V
COM223003: Database Management System

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 Structure
COM222012:Advanced Data Structures

Companion Course:- COM222004: Database Management System Lab

Course Objectives:
- To understand the fundamentals of database management System and database query languages
- To know the principles of database design and transaction management
- To study database system architecture and NOSQL databases

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

	Course Outcomes	**Bloom's Level**
CO1	Illustrate applications of databases, and features of RDBMS	2-Understand
CO2	Build database queries using SQL, PL/ SQL and NoSQL queries using MongoDB.	3-Apply
CO3	Construct ER diagram to represent logical design of a database	3-Apply
CO4	Apply different normalization techniques to minimize redundancy and anomalies	3-Apply
CO5	Explain various protocols of transaction management and concurrency control in databases	2-Understand

COURSE CONTENTS

Unit I	**Relational Model and SQL**	**(08 hrs)**	**CO1, CO2**

Introduction: Basic concepts, Advantage of DBMS over file processing system, Data Abstraction, Database Language, Structure of DBMS, Data Modeling, database applications.
RDBMS: Basic concepts, Attributes and Domain, Integrity Constraints.
SQL: Introduction to Relational Algebra and Tuple Relational Calculus, Introduction to SQL, SQL Data types and Literals, DDL, DML, DCL, TCL, SQL Select Query and Clauses.
Topic for Self-Study : Codd's Rules

Unit II	**Advanced SQL and PLSQL**	**(06 hrs)**	**CO2**

SQL Advanced Features: Set Operation, Aggregate Function, Null Values, Nested Sub Query, View, Joins, Sequence, Index, Introduction to Embedded and Dynamic SQL.
Introduction to PL/SQL: Data types, Procedures, Functions, Cursor, Trigger, Package, Assertions, Roles and Privileges.
Topic for Self-Study : Oracle Database Architecture

Unit III	**Database Design: Entity- Relationship Model and Relational Database Design**	**(08 hrs)**	**CO3**

Database Design and ER Model: ER Model, Extended E-R Features, converting ER model and EER model to tables, schema diagrams.
Relational Database Design: Functional Dependency, Normalization 1NF, 2NF and 3NF
Topic for Self-Study : BCNF.

Unit IV	**NO SQL Database**	**(08 hrs)**	**CO4**

Database-system Architecture: Centralized and Client-Server Architecture, Server System Architecture, Introduction to Parallel and Distributed databases.
NoSQL Databases: Structured, Unstructured Data and Semi-Structured Data, Comparison of RDBMS and NoSQL, CAP theorem and BASE property.
Types of NoSQL Databases: Key-value store, document store, graph, wide column stores.
Mongo DB: Data types, CRUD operations, Aggregation, Indexing, Sharding.

Unit V	**Transaction Management**	**(06 hrs)**	**CO5**

Transaction: Transaction concept, Transaction state, Transaction Property, Concurrent Executions
Serializability: Conflict serializability, View Serializability, Testing for Serializability, Deadlock prevention, Deadlock Detection and Recovery from deadlock.
Concurrency Control Protocols: Two phase Locking, Timestamp-based protocol.
Recovery: Failure classification, Shadow-Paging and Log-Based Recovery

Text Books

1. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", 6 th Edition Tata McGraw Hill Publishers, ISBN 0-07-120413-X.
2. Kristina Chodorow, "MongoDB: The Definitive Guide", 3rd Edition, Oreilly Publications, ISBN 1491954469

Reference Books

3. C J Date, "An Introduction to Database Systems" ,Addison-Wesly, ISBN:0201144719
4. Pramod J. Sadalage, Martin Fowler, "NoSQL Distilled", Addisen Wesley publication, ISBN:0201144719

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	-	-	-	-	-	-	-	-	3	3	2
CO2	3	2	2	-	2	-	-	-	-	-	-	**2**	2	2
CO3	3	2	3	-	2	-	-	-	-	-	-	2	2	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	-	-
Average	3	2	2.	-	2	-	-	-	-	-	-	2	2.	2.

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, Unit 4 (Quiz 15 marks each and will be converted to 15 Marks)	15
2	Theory assignment on Unit-5 (One Assignment on 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)

T. Y. B. Tech. Computer Engineering **Pattern 2022 Semester: V** **COM223004: Database Management System Lab**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 02 hrs/week	**01**	**Termwork: 25 Marks** **Practical Exam: 25 Marks**
Prerequisite Courses: - COM222007: Data Structures Lab, COM222017: Advanced Data structures Lab		
Companion Course: - COM222003: Database Management System		

Course Objectives:

- To understand the fundamentals of database management System and database query languages
- To know the principles of database design and transaction management
- To study database system architecture and NOSQL databases

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

	Course Outcomes	**Bloom's Level**
CO1	Make use of normalized relational database schemas to represent real-world scenarios	3-Apply
CO2	Build simple and complex SQL queries and PL/ SQL code to retrieve, manipulate relational database	3-Apply
CO3	Construct ER diagram to represent logical design of a database	3-Apply
CO4	Build database queries using MongoDB to retrieve, manipulate NoSQL databases	3-Apply
CO5	Develop database-driven applications using programming languages and frameworks that interact with relational database systems or NoSQL databases	3-Apply

List of Laboratory Experiments / Assignments

Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	**SQL Queries** Consider the given Database Schema: employee (employee-name, street, city) works (employee-name, company-name, salary) company (company-name, city) manages (employee-name, manager-name) Write SQL queries for the following 1. Find the names of all employees who work for First Bank Corporation. 2. Find the names and cities of residence of all employees who work for First Bank Corporation 3. Find the names, street addresses, and cities of residence of all employees who work for First Bank Corporation and earn more than Rs.10,000. 4. Find all employees in the database who live in the same cities as the companies for which they work.	CO1, CO2

	5. Find all employees in the database who live in the same cities and on the same streets as do their managers. 6. Find all employees in the database who do not work for First Bank Corporation. 7. Find all employees in the database who earn more than each employee of Small Bank Corporation. 8. Assume that the companies may be located in several cities. Find all companies located in every city in which Small Bank Corporation is located. 9. Find all employees who earn more than the average salary of all employees of their company. 10. Find the company that has the most employees. 11. Find the company that has the smallest payroll. 12. Find those companies whose employees earn a higher salary, on average, than the average salary at First Bank Corporation.	
2	**Index, Sequence and View** Consider the given relational table: employee(empno , empname, designation, city, salary, zipcode, county) Write SQL queries for the following 1. Create a sequence used to generate employee numbers for the empno column of the emp table. 2. Create an Index on the county. 3. Find the country whose zipcode = 071 and check whether the query uses the Index and write your observation. 4. Create a view for employees having salary < 50000 and stays in 'Mumbai' 5. Display a Count of employees who stays in 'Mumbai' 6. Find average salary of employees of a created view 7. Display employee names who stays on same street of a view	CO1, CO2
3	**SQL Joins** Consider the given database schema: Student (studentid , studentname,instructorid,studentcity) Instructor(instructorid,Instructorname,instructorcity,specialization) Use all types of Joins 1. Find the instructor of each student. 2. Find the student who is not having any instructor. 3. Find the student who is not having any instructor as well as instructor who is not having student. 4. Find the students whose instructor's specialization is computer. 5. Create a view containing the total number of students whose instructor belongs to "Pune".	CO1, CO2
4	**ER Modelling and Normalization:** Conceptual Design using ER features using tools like ERD plus, ER Win etc. (Identifying entities, relationships between entities, attributes, keys, cardinalities, generalization, specialization etc.) Convert the ER diagram into relational tables and normalize the Relational data model.	CO3
5	**PL/SQL block** Create a database with following schemas Borrower(Rollin, Name, DateofIssue, NameofBook, Status) & Fine(Roll_no,Date,Amt) 1. Write a PL/SQL block to accept input for Borrower table.	CO1, CO2

	2. Write a PL/SQL block using control structures to calculate fine by using the following rules: a. check the number of days (from date of issue), if days are between 15 to 30 then fine amount will be Rs 5 per day b. If no. of days>30, per day fine will be Rs 50 per day c. for days less than 30, Rs. 5 per day. After submitting the book, status will change from I to R. If condition of fine is true, then details will be stored into fine table.	
6	**Cursors** Write a block in PL/SQL to print a report which shows that, the employee id, name, hire date, and the incentive amount they achieved according to their working experiences, who joined in the month of current date. Use explicit cursor	CO1, CO2
7	**Database Trigger** Create a Library database with the schema Books(AccNo, Title, Author, Publisher, Count). a. Create a table Library_Audit with same fields as of Books and Date and status column b. Create a before trigger to insert records into Librry_Audit table if there is deletion in Books table, insert date of deletion and status as deleted Create a after trigger to insert records into Librry_Audit table if there is updation in Books table , insert date of updation and status as updated	CO1, CO2
8	**Database Connectivity**: Write a program to implement Menu driven MySQL/Oracle database connectivity with any front end language for Python/Java/PHP to implement Database navigation operations (add, delete, edit etc.)	CO5
9	**MongoDB Queries** Implement the following MongoDb Query 1. Create a collection named books. 2. Insert 5 records with field TITLE,DESCRIPTION,BY,URL,TAGS AND LIKES 3. Insert 1 more document in collection with additional field of user name and comments. 4. Display all the documents whose title is 'mongodb'. 5. Display all the documents written by 'Ajay' or whose title is 'mongodb'. 6. Display all the documents whose title is 'mongodb' and written by 'Ajay'. 7. Display all the documents whose like is greater than 10. 8. Display all the documents whose like is greater than 100 and whose title is either 'mongodb' or written by 'Ajay'. 9. Update the title of 'mongodb' document to 'mongodb overview' 10. Delete the document titled 'nosql overview'. 11. Display exactly two documents written by 'Ajay'. 12. Display the second document published by 'Ajay'. 13. Display all the books in the sorted fashion. Insert a document using save method.	CO4

10	**MongoDB Aggregation and Indexing** Create the collection Books having the following fields TITLE, DESCRIPTION, BY, URL, TAGS AND LIKES. Implement the following Aggregation and Indexing Queries 1. Find the number of books published by "Ajay" 2. Find books which have minimum likes and maximum likes published by "Ajay". 3. Find the average number of likes of the books published by Ajay. 4. Find the first and last book published by "Ajay".. 5. Create an index on the author name. Display the books published by "Ajay" and check if it uses the index which we have created	CO4
11	**Mini Project:** Form a group of 3 or 4 students and Using the database concepts covered, develop an application with following details: 1. Define a problem statement 2. Follow the Software Development Life cycle and other concepts learnt in Software Engineering Course throughout the implementation. 3. Develop application considering: Front End: Java/Perl/PHP/Python/Ruby/.net/any other language Backend : MongoDB/ MySQL/Oracle 4. Test and validate applications using Manual/Automation testing.	CO1 to 5
Additional Lab Assignments		
1	**ER Modeling** Conceptual Design using ER features using tools like ERD plus, ER Win etc. (Identifying entities, relationships between entities, attributes, keys, cardinalities, generalization, specialization etc.) Convert the ER diagram into relational tables and normalize the Relational data model. ER model of a Hospital management using the following description . Each of these entities have their respective attributes which are – Patients - ID(primary key), name, age,visit_date Tests- Name(primary key), date, result Doctor- ID(primary key), name, specialization	CO3
2	**SQL Queries** Consider the following schema account(acc-no,branch-name,balance) depositor(cust-name,acc-no) borrower (cust-name, loan-no) loan (loan - no, branch - name, amount) Write following queries using SQL 1. Create tables using proper primary keys 2. Update information of particular customer 3. Find the customers having loan less than 1 lac	CO1, CO2

	4. Display account number and customer name starting with 'P' 5. Display name of the depositor with balance 6. Find names of all customers who have a loan at the 'Redwood branch'. 7. Find all customers who have an account and loan or both. 8. Find all customers who do not have loan 9. Find average account balance at each branch. 10. Find the name of borrower having maximum loan amount	
3	**PLSQL Block** Write a Stored Procedure namely proc_Grade for the categorization of students. If marks scored by students in examination is <=1500 and marks>=990 then students will be placed in distinction category if marks scored are between 989 and 900 category is first class, if marks 899 n 825 category is Higher Second Class and Less than 825 and > 600 have 'Pass Class'. Insert the result in Result table for all Write a Stored Procedure for calculating Number of students getting each class e.g Distinction - 10 students, First class -5 students. Insert count in the Analysis table Write a PL/SQLblock to use procedures created with the above requirement. Stud_Marks(roll, name, total_marks) Result(Roll,Name, Class) Analysis(class , count)	CO1, CO2
4	Cassandra Queries: Design and Develop Queries using CRUD operations	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++

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 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)

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	-	-	-	-	-	-	-	-	3	3	2
CO2	2	2	2	-	2	-	-	-	-	-	-	**2**	2	2
CO3	3	2	3	-	2	-	-	-	-	-	-	2	2	-
CO4	2	3	-	-	3	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	3	-	-	-	2	-	-	-	-	-
Average	2.40	2.20	2.25	-	2.5	-	-	-	2	-	-	2.33	2.33	2.00

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

T. Y. B. Tech. Computer Engineering
Pattern 2022 Semester: V
COM223005: Design and Analysis of Algorithms Lab

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical: 02 hrs/week	01	Termwork: 25 Marks Practical Exam : 25 Marks

Prerequisite Courses: - COM222007:Data Structures Lab
COM222017:Advanced Data Structures Lab

Companion Course :- COM223001:Design and Analysis of Algorithms

Course Objectives:

- To develop problem solving abilities using mathematical modeling
- To apply algorithmic strategies and analyze while solving problems
- To develop time and space efficient algorithms
- To design algorithmic assignments using various algorithmic strategies

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

	Course Outcomes	Bloom's Level
CO1	Build efficient design, analysis and testing of algorithms and calculate its computational complexities	3-Apply
CO2	Apply greedy algorithm to various problems.	3-Apply
CO3	Develop a program based on dynamic programming and backtracking.	3-Apply
CO4	Make use of branch and bound concept to solve various problems.	3-Apply

List of Laboratory Experiments / Assignments

Sr. No.	Laboratory Experiments / Assignments	CO Mapped
1	Develop a program to design a function for Binary Search using Divide and Conquer Strategies. Also compute it's time complexity.	CO1
2	Develop a program to design a class for Concurrent Quick Sort Using Divide and Conquer Strategies. Also Compute it's time complexity.	CO1
3	Develop a program to implement Huffman Encoding using a greedy strategy.	CO1,CO2
4	Develop a program to solve a fractional Knapsack problem using a greedy method.	CO1,CO2
5	Develop a program to implement 0/1 Knapsack problem using Dynamic Programming.	CO1,CO3
6	Develop a program to implement Optimal Binary Search Tree using Dynamic Programming.	CO1,CO3
7	8-Queen matrix is stored having first queen placed; use backtracking to	CO1,CO3

	place remaining queens to generate the final 8-queen matrix using python.	
8	Develop a program to implement Graph Coloring using backtracking method.	CO1,CO3
9	Develop a program to implement 0/1 Knapsack problem using branch and bound.	CO1,CO4
10	Develop a program for Job Assignment Problem using Branch and Bound.	CO1,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++
Programming Language :- C++/Java/Python

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 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)

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	3	2	2	2	2	2	-	-	-	2	3	2
CO2	2	3	3	2	3	2	2	2	-	-	-	2	3	2
CO3	2	3	3	2	3	2	2	2	-	-	-	2	3	2
CO4	2	3	3	2	3	2	2	2	-	-	-	2	3	2
Average	2	3	3	2	2	2	2	2	-	-	-	2	3	2

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

T. Y. B. Tech. Computer Engineering
Pattern 2022 Semester: V
COM223006A: Internet of Things

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

Prerequisite Courses: ------

Companion Course : COM223007A: Internet of Things Lab

Course Objectives:

- To understand fundamentals of IoT system.
- To study various IoT protocols.
- To learn various elements of IoT security
- To use python programming in IoT

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

	Course Outcomes	**Bloom's Level**
CO1	Explain the characteristics and methodology to design IoT system	2-Understand
CO2	Identify various devices required for different IoT applications.	3-Apply
CO3	Describe various IoT protocols for communication between different endpoints to develop client server application.	2-Understand
CO4	Explain various elements of IoT Securities	2-Understand
CO5	Make use of various cloud offering available for IoT Platform	3-Apply

COURSE CONTENTS

Unit I	**Introduction to IoT and its Platforms Design Methodology**	**(09 hrs)**	**CO1**

Definition and characteristics of IoT, Applications, Physical design of IoT, Things of IoT, IoT Protocols, Logical design of IoT, IoT functional blocks, IoT communication models, IoT Communication APIs, IoT enabling technologies, IoT levels and deployment templates, IoT Issues and Challenges.

IoT Platform Design Methodology: Purpose and requirement specification, Process specification, Domain model specification, Information model specification, Service specifications level specification, Functional view specification, Operational view specification, Device and component integration, Application development

Unit II	**IoT Physical Devices and Programming Raspberry Pi with Python**	**(07 hrs)**	**CO2**

Basic building blocks of IoT device, Sensors and actuators, Connectivity technologies, Exemplary device: Raspberry Pi, Raspberry Pi interfaces, Beagle board and Other IoT Devices.

Programming Raspberry Pi with Python: Working with digital and analog input output, Retrieving data from the real world with sensors, Working with accelerators, Temperature sensor, Displaying information and performing action using LCD and Servo motors, Working with cloud publishing data to the cloud-Python pub nub.

Unit III	IoT Protocols	(07 hrs)	CO3
Four pillars of IoT: M2M, WSN , SCADA and RFID. **Protocol Standardization for IoT**: Issues with IoT Standardization, Unified Data Standards. **IoT Protocols:** IEEE 802.15.4, BACNet, Modbus, KNX, Zigbee, 6LoWPAN,LoRa			
Unit IV	**IoT Security**	**(06 hrs)**	**CO4**
Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modeling, Key elements of IoT Security: Identity establishment, Access control, Data and message security, Non-repudiation and availability, Security model for IoT.			
Unit V	**IoT Physical servers and Cloud offering**	**(07 hrs)**	**CO5**
Introduction to Cloud Storage Models, Communication API, WAMP: AutoBahn for IoT, Xively Cloud for IoT, Python Web Application Framework: Djanjo, Amzon Web Services for IoT, SkyNet IoT Messaging Platform.			

Text Books

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515
2. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012. ISBN : 9781439892992
3. Gastón C. Hillar, Internet of Things with Python Interact with the world and rapidly prototype IoT applications using Python
4. Dieter Uckelmann, Mark Harrison, Florian Michahelles, “Architecting the Internet of Things”, Springer, 2011. ISBN: 978-3-642-19156-

Reference Books

1. David Easley and Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning About a Highly Connected World”, Cambridge University Press, 2010, ISBN:10: 0521195330
2. Olivier Hersent, Omar Elloumi and David Boswarthick, “The Internet of Things: Applications to the Smart Grid and Building Automation”, Wiley, 2012, 9781119958345
3. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012, ISBN:978-1-119-99435-0
4. Barrie Sosinsky, “Cloud Computing Bible”, Wiley-India, 2010.ISBN : 978-0-470-90356-8
5. Adrian McEwen, Hakim Cassimally, “Designing the Internet of Things”, Wiley, 2014, ISBN: 978-1-118-43063-7

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	-	-	2	-	-	-	-	-	-	3	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	-	-	-	-	3	-	3	-	-	-	3	-	-
CO5	3	-	-	-	2	-	-	-	-	-	-	3	-	-
Average	3	2.33	-	-	2	3	-	3	-	-	-	3	-	-

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Quiz on Unit I, Unit II and Unit III each of 10 marks (Total marks will be converted to 10 marks)	10
2	Assignment on Unit IV and Unit V each of 10 marks (Total marks will be converted to 10 marks)	10
	Total	**20**

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

T. Y. B. Tech Computer Engineering
Pattern 2022 Semester: V
COM223006B: Augmented Reality & Virtual Reality

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: - COM222012: Advanced Data Structures, COM222002: Computer Graphics, COM222009: Programming Paradigms and Computer Graphics Lab, FYE221011: Programming in C++.

Course Objectives:
- To study concepts of Augmented Reality
- To gain knowledge of various input and output devices required for interacting in virtual world
- To explain AR techniques
- To know Virtual Reality and its applications

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

	Course Outcomes	Bloom's Level
CO1	Explain the concepts of the Augmented Reality (AR).	2-Understand
CO2	Describe architecture of AR	2-Understand
CO3	Interpret different AR techniques	2-Understand
CO4	Describe fundamental principles of Virtual Reality (VR)	2-Understand
CO5	Outline Human Factors in VR Evaluations.	2-Understand

COURSE CONTENTS

Unit I	Augmented Reality	(06 hrs)	CO1

Introduction to Augmented Reality, History of Augmented Reality, Taxonomy, Technology and Features of Augmented Reality, Difference Between AR and VR, Challenges With AR, AR Systems and Functionality, Augmented Reality Methods, Visualization Techniques For Augmented Reality, Mobile Projection Interfaces.

Unit II	AR & VR Architecture	(08 hrs)	CO2

Audio Displays, Haptic Displays, Visual Displays, Visual Perception, Spatial Display Model. Tracking, Sensors Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion.

Unit III	AR Techniques	(08hrs)	CO3

Introduction to Marker Based Approach, Marker-Based Tracking, Types of Markers, Marker Camera Pose and Identification, Visual Tracking, Marker Types, Template Markers, 2D Barcode Markers, Imperceptible Markers.
Marker Less Approach, Localization Based Augmentation, Real World Examples, Tracking Methods Visual Tracking, Feature Based Tracking, Hybrid Tracking, Initialization and Recovery.

Unit IV	Introduction to Virtual Reality	(08hrs)	CO4
Introduction to Virtual Reality, The three I's of virtual reality, Commercial VR technology, five classic components of a VR system. Input Devices, Trackers, Navigation, Gesture Interfaces, Three-dimensional position trackers, Manipulation Interfaces, Output Devices, Graphics displays, Sound displays, Haptic feedback.			
Unit V	**VR Applications**	**(06hrs)**	**CO5**
Testbed Evaluation of Universal VR Tasks, VR Health and Safety Issues, Direct Effects of VR Simulations on User, VR in social aspects. VR applications in industry, Medical applications, Military applications, Robotics applications.			

Text Books

1. Steve aukstakalnis, Practical Augmented Reality: A Guide to the Technologies, Applications and Human Factorsfor AR and VR, Adision Wesley.
2. Dr. Rajiv Chopra, Virtual and Augmented Reality, Khanna Book Publishing, 2021.

Reference Books

1. Burdea, G. C., P. Coffet., "Virtual Reality Technology", 2nd edition, Wiley-IEEE Press, 2006.
2. Steven M. LaValle, "Virtual Reality", Cambridge University Press, 2016
3. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
4. William R Sherman, Alan B Craig, "Understanding Virtual Reality: Interface, Application and Design", "The Morgan Kaufmann Series in Computer Graphics", Morgan Kaufmann Publishers, San Francisco, CA, 2002.

Strength of CO-PO / PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	3	-	-	-	-	-	-	-	3	3
CO3	3	-	-	-	3	-	-	-	-	-	-	-	3	3
CO4	3	-	-	-	3	-	-	-	-	-	-	-	3	3
CO5	3	-	-	-	-	3	-	3	-	-	-	-	3	3
Average	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**3**

Guidelines for Continuous Comprehensive Evaluation of Theory Course

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

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

T. Y. B. Tech. Computer Engineering
Pattern 2022 Semester: V
COM223006C: Software Testing and Quality Assurance

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: - COM222015 Software Engineering and Project Management

Course Objectives:

- To study the basic principles of software testing
- To understand various methods of software testing
- To learn the basic concepts of software testing life cycle and test case design
- To know concepts of the software quality assurance, metrics, and defect prevention techniques

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

	Course Outcomes	**Bloom's Level**
CO1	Explain the systematic approach of software testing	2- Understand
CO2	Apply both black box and white box testing techniques	3-Apply
CO3	Make use of software testing methodologies	3-Apply
CO4	Build appropriate test cases	3-Apply
CO5	Select appropriate testing metrics	3-Apply

COURSE CONTENTS

Unit I	**Introduction of Software Testing**	**(06 hrs)**	**CO1**

What is software testing? Why is testing necessary? Testing Principles, Best Practices in Testing, Skills for Testing, Various Task Involved In Testing, Difference between Verification & Validation, Difference between QA & QC, V-Model, Test Case Generation, SDLC Vs. STLC, SDLC – Software Development Life Cycle, Waterfall, Prototype, Spiral , Incremental (Agile methodology and Scrum Framework).

Unit II	**Software Testing Strategies**	**(08 hrs)**	**CO2**

Testing Strategies: Unit Testing, Integration Testing, System Testing, Smoke, Regression Testing, Acceptance Testing. Functional/Non Functional Testing. Testing Tools, Categorization of testing methods: Manual Testing, Automation Testing and Automated Testing Vs. Manual Testing
Non Functional Testing: Performance Test, Memory Test , Scalability Test, Compatibility Test, Security Test, Cookies Test, Session Test, Recovery Test, Installation Test, Ad-hoc Test, Risk Based Test, Compliance Test. McCall's Quality Factors, FURPS.

Unit III	**Software Testing Methodologies**	**(08hrs)**	CO3

Validation & Verification, White/Glass Box Testing, Black Box Testing, Grey Box Testing, Statement Coverage Testing, Branch Coverage Testing, Path Coverage Testing, Conditional Coverage Testing, Loop Coverage Testing, Boundary Value Analysis, Equivalence Class Partition, State Based Testing,

Cause Effective Graph, Decision Table, Use Case Testing, Exploratory testing and Testing Metrics, Testing GUI.

Unit IV	Software Testing Life Cycle and Test Cases	**(08hrs)**	**CO4**

Software Testing Life Cycle: Requirements Analysis/Design, Traceability Matrix, Test Planning, Objective, Scope of Testing, Schedule, Approach, Roles & Responsibilities, Assumptions, Risks & Mitigations, Entry & Exit Criteria, Test Automation, Deliverables

Test Cases Design: Write Test cases, Review Test cases, Test Cases Template, Types of Test Cases, Difference between Test Scenarios and Test Cases. Test Environment setup; Understand the SRS, Hardware and software requirements, Test Data.

Test Execution: Execute test cases, Error/Defect Detecting and Defect Life Cycle, Types of Bugs , Art of Debugging,. Debugging Approaches, Reporting the Bugs, Severity and priority, Test Closure, Criteria for test closure, Test summary report.

Unit V	**Quality and Process Improvement**	**(06hrs)**	**CO5**

Define What Is Quality, Application of Concept of Quality to Software Application, Quality Assurance, Quality Control, Testers Contribution To Quality of Software Application,

Software Testing Metrics: Test Measurements, Test Metrics, Metric Life Cycle, Types of Manual Test Metrics. TQM, Four Principles of TQM.

Quality Standards: CMMI (Capability Maturity Model Integration), ISO, IEEE, Six Sigma, Motorola.

Text Books

1. M G Limaye, “Software Testing Principles, Techniques and Tools‖”, Tata McGraw Hill, ISBN: 9780070139909.
2. Srinivasan Desikan, Gopal Swamy Ramesh, “Software Testing Principles and Practices”, Pearson, ISBN-10: 817758121X .

Reference Books

1. Naresh Chauhan, “Software Testing Principles and Practices", OXFORD, ISBN-10: 0198061846. ISBN-13: 9780198061847
2. Allan C. Gillies, “Software Quality: Theory and Management”, Cengage Learning
3. Stephen H. Kan, “Metrics and Models in Software Quality Engineering”, Pearson Education, 2002.
4. Daniel Galin, “Software Quality Assurance: From Theory to Implementation”, Pearson Education, 2004

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	-	3	-	-	-	-	-	-	3	-	-
CO2	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO3	3	3	3	2	3	-	-	-	-	-	-	3	-	3
CO4	3	3	3	2	3	-	-	-	-	-	-	3	-	3
CO5	3	3	3	2	3	-	-	-	-	-	-	3	-	-
Average														

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Quiz on Unit I, Unit II and Unit III (Quiz of 10 marks each will be converted to 10 marks)	10
2	Assignment on Unit IV and Unit V (Assignment of 10 marks each will be converted to 10 marks)	10
	Total	**20**

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

T. Y. B. Tech. Computer Engineering **Pattern 2022 Semester: V** **COM223007A: Internet of Things Lab**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 02 hrs/week	**01**	**Continuous Comprehensive Termwork: 25 Marks** **Oral : 25 Marks**
Prerequisite Courses: -----		
Companion Course: COM223006A: Internet of Things		

Course Objectives:

- To test the functionality of various sensors and actuators
- To use python for GPIO programming in IOT
- To develop client server application in IoT using various protocols

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

	Course Outcomes	**Bloom's Level**
CO1	Make use of various actuators and sensors available for sensing the real world	3-Apply
CO2	Design and construct IoT application for specified requirement	3-Apply
CO3	Apply various IoT protocols for communication between different endpoints to develop client server applications.	3-Apply
CO4	Construct an application for remote sensing, monitoring and controlling appliances.	3-Apply

List of Laboratory Experiments / Assignments

Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	Interface the I/O devices like LED, Switch, Buzzer to Raspberry Pi and write GPIO programming in python to test its functionality	CO1
2	Write an application to detect obstacles using Proximity sensor and notify the user using LED or Buzzer.	CO1, CO2
3	Write an application to read the environment temperature. If temperature crosses a threshold value, the application indicates the user using LED or Buzzer.	CO1, CO2
4	Using the light sensor, monitor the surrounding light intensity and automatically turn on/off the high intensity LED by taking some predefined threshold light intensity value.	CO1, CO2
5	Display any RSS news feed headline on a LCD display connected to a device. Extract data from any website and flash it on an LCD	CO1, CO3
6	Interface the USB webcam with the device and capture the image .	CO1
7	Create an account on Thing speak cloud and write an application to	CO1, CO3

	publish the temperature information and interested applications can subscribe.	
8	Create a simple web interface for Raspberry-Pi to control the connected LEDs remotely through the interface	CO1, CO3,CO4
9	Interface an Android smartphone with an Arduino /Raspberry pi via Bluetooth to control an LED from your phone.	CO1, CO3,CO4
10	Mini Project using Raspberry pi to identify and solve any real world problem	CO1 to 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.
Programming tools recommended: - Raspberry-Pi/Arduino

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 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)

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO2	3	3	3	-	2	-	-	-	-	-	-	3	-	3
CO3	3	2	-	-	2	-	-	-	-	-	-	3	-	-
CO4	3	3	3	-	2	-	-	-	-	-	-	3		-
Average	3	2.75	3	-	2	-	-	-	-	-	-	3	-	3

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

T. Y. B. Tech Computer Engineering Pattern 2022 Semester: V COM223007B: Augmented Reality & Virtual Reality Lab		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 02 hrs/week	**01**	**Term work: 25 Marks Oral Exam : 25 Marks**

Prerequisite Courses: - COM222012: Advanced Data Structures, COM222002: Computer Graphics, COM222009: Programming Paradigms and Computer Graphics Lab, FYE221011: Programming in C++.

Companion Course: COM223006B: Augmented Reality & Virtual Reality

Course Objectives:

- To study software and hardware requirements of AR and VR
- To get acquainted with methods of designing and rendering immersive environment
- To design and develop virtual reality tasks
- To evaluate VR application

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

	Course Outcomes	**Bloom's Level**
CO1	Make use of AR and VR development tools	2- Understand
CO2	Demonstrate the use of AR,VR and MR devices	3- Apply
CO3	Design and develop a game scene	6- create
CO4	Build AR and (or) VR application	6- create

List of Laboratory Experiments / Assignments

Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1.	Study of various AR & VR Development tools such as UNITY 3D IDE and its documentation.	CO1
2.	Create a C# script that plays a video when an image is scanned using AR App (AR Core & Unity).	CO3
3.	Develop & Deploy a simple marker-based AR app in which you have to write a C# program to play video on tracking a particular marker.	CO3,CO4
4.	Design and Develop the following using Vuforia Engine developer portal: I. Plane detection II. Marker based Tracking (Create database of objects to be tracked in Vuforia) III. Object Tracking and deploy it on AR devices.	CO3, CO4
5.	Demonstration of the working of HTC Vive, Oculus Quest 2, Microsoft Hololens2.	CO2
6.	Develop a scene in Unity that includes: I. A cube, plane and sphere, apply transformations on the 3 game	CO4

	objects. II. Add a video and audio source.	
7.	Develop a scene in Unity that includes a cube, plane and sphere. Create a new material and texture separately for three Game objects. Change the color, material and texture of each Game object separately in the scene. Write a C# program in visual studio to change the color and Material/texture of the game objects dynamically on button click.	CO4
8.	Develop and deploy a VR app, Add interactive elements to the environment, such as objects that can be picked up, manipulated, or triggered by the user's actions.	CO4
9.	A. Create a multiplayer VR game (battlefield game). The game should keep track of score, no. of chances/lives, levels (created using different scenes), involve interaction, animation and immersive environment. OR B. Create a treasure hunt AR application which should have the following features: • A help button for instruction box to appear • A series of markers which would give hints on being scanned • Involve interaction, sound, and good UI OR C. Evaluate an existing VR application or a VR game.	CO1 to 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.
Practice using AR & VR tools such Unity, Vuforia, Blender, Unreal.
Operating System recommended: - Linux or its derivative , Windows 10 and above
Programming tools recommended: - Open Source line gcc/g++/C#

Guidelines for Student's Lab Journal

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

Guidelines for Term-work Assessment

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

Strength of CO-PO PSO Mapping

	PO												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	1	2	-	2	-	-	-	-	-	-	-	3	3
CO3	2	2	-	-	2	-	-	-	-	-	-	-	3	3
CO4	2	-	2	1	2	-	-	-	-	-	-	-	3	3
CO5	2	2	2	1	2	-	-	-	-	-	-	2	3	3
Average	**2**	**1.66**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**

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

T. Y. B. Tech. Computer Engineering **Pattern 2022 Semester: V** **COM223007C Software Testing and Quality Assurance Lab**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 02 hrs/week	**01**	**Term work: 25 Marks** **Oral Exam : 25 Marks**

Prerequisite Courses: - COM222015 Software Engineering and Project Management

Course Objectives:

- To analyse the requirements for the given problem statement
- To design and implement various solutions for the given problem
- To employ various design strategies for software testing
- To construct control flow graphs for white box testing
- To create appropriate document for the software artefact

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

	Course Outcomes	**Bloom's Level**
CO1	Understand and describe the basic concepts of functional (black box) software testing.	2-Understand
CO2	Identify a number of test styles and techniques and assess their usefulness in the context of software testing	3-Apply
CO3	Understand the basic application of techniques used to identify useful ideas for testing	2-Apply
CO4	Verify that the end result meets the end user requirements	3-Apply
CO5	Characterize a good bug report, peer-review reports to improve report writing	3-Apply

List of Laboratory Experiments / Assignments

Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	Design and develop a code for binary search algorithm C++/Java. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.	
2	Design, and develop a code for quick sort algorithm using C++/Java. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.	
3	Design and develop a code using C++/Java to implement an absolute letter grading procedure, making suitable assumptions. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.	
4	Design and develop a code using C++/Java to implement the Next Date function. Analyze it from the perspective of boundary value testing, derive different test cases,	

<table>
<tr><td></td><td>execute these test cases and discuss the test results.</td><td></td></tr>
<tr><td>5</td><td>Leave Management System with following modules:
a. Login – Two types of User: Admin and User
b. Admin Functionalities:
i. Manage Leave Types
ii. Manage User Leaves
iii. Manage Users
iv. Manage Different Shifts
v. Manage Reporting Groups and Team Structure
c. Time and Attendance
i. User can view his/her attendance detail
ii. Admin can view user's attendance log
iii. Admin can generate various reports like LateIn, EarlyOut, etc.
d. Leaves
i. User can apply leave and Admin can reject/approve
ii. User can view his leave request log, can modify and cancel as well
** Many other functionalities can be added to make it more complex</td><td></td></tr>
<tr><td>6</td><td>In Airline reservation system, the following features need to be tested namely,
a. Login
b. Search and book flights
c. Search and book packages
d. Register Feature not in scope,
e. Search and book hotels
– Pre-requities: Database & Payment gateway's sandbox environment access should be available.
– Prepare the Test Plan for the above with all the possible criteria need to be considered.
– Prepare the Test Cases for the features in scope to be tested.(At least one for each above mentioned feature)
– Prepare the Defect Report.</td><td></td></tr>
<tr><td>7</td><td>Healthcare Web application with following modules:
a. Patient Registration
b. Scheduling
c. Treatment
d. Billing</td><td></td></tr>
<tr><td></td><td><u>Follow the instructions for assignment Number 5, 6, and 7</u>
Part 1: Test Planning
a) Prepare Quality Plan for any Application like online shopping etc.
b) Prepare Test Plan for any Application like Railway Reservation System etc.
Part 2: Test Case Design
Part 3: Software Testing (Manual)
a) Create Test cases : Unit testing, Integration testing , System testing and Acceptance testing for Application
b) Perform manual testing using test case created and prepare test Metrics
Suggested Template for Test case creation.
<table>
<tr><th>Sr. No. #</th><th>Test condition / Steps</th><th>Input</th><th>Expected Result</th><th>Actual Result</th><th>Pass/Fail</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
Write test cases using following techniques (Suggested)
➢ Coverage
➢ Boundary Value Analysis (BVA)</td><td></td></tr>
</table>

	➢ Equivalence Partition (EP) ➢ State Transition Technique ➢ Error Guessing Technique **Part 4: Software Testing (Automated)** **Tools: Selenium, Jira** Test automation – script creation and execution	

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
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

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO2	3	3	3	-	2	-	-	-	-	-	-	3	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	-	-	-	2	-	2	-	-	-	3		-
CO5	3	2	-	-	-	-	-	-	-	-	-	3	-	-
Average	3	2.4	3	-	2	2	-	2	-	-	-	3	-	3

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

T. Y. B. Tech. Computer Engineering **Pattern 2022 Semester: V** **COM223008: Management Information Systems**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory: 02 hrs/week	**02**	**Continuous Comprehensive Evaluation: 50 Marks**

Prerequisite Courses: -

Companion Course: -

Course Objectives:

- To understand concepts of Management Information System and Business intelligence for MIS.
- To recognize the need of an information system in today's global business with tools and technologies.
- To identify IT infrastructure components and to study security in the Information System.
- To understand the importance of project management and the international information system.
- To understand the concepts of decision support systems for business applications.

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

	Course Outcomes	**Bloom's Level**
CO1	Explain the concepts of management information system and business intelligence for MIS.	2-Understand
CO2	Illustrate the need of information system using global business and ethical issues.	3-Apply
CO3	List the IT infrastructure components and explain security in the information system	2-Understand
CO4	Demonstrate the importance of project management and extend its use in the international information system	3-Apply
CO5	Illustrate the concepts of decision support systems for business applications.	3-Apply

COURSE CONTENTS

Unit I	**An Overview of Management Information System**	**(04hrs)**	**CO1**

Management information system: Concept, Definition, Role of MIS, Impact of MIS, Management as a Control System: The functions of Management, Managerial Roles, The Levels of Management, Support to the Management, Management effectiveness and MIS, Organization as a System. Decision Making, Business intelligence for MIS.

Unit II	**Organization, Management and Network Enterprise**	**(05hrs)**	**CO2**

Perspectives on Information System. Global E-business and collaboration: Business Processes, Types of Information Systems, Tools and technologies for collaboration and teamwork, E-mail and Instant Messaging, Social Networking, Virtual worlds, Internet based Collaboration Environments. Information system organization and strategy, Ethical and social issues in information system.

Unit III	**Information Technology Infrastructure**	**(05hrs)**	**CO3**

IT infrastructure and Emerging Technologies: IT infrastructure and its components, Hardware and software platform trends, Management issues.
Foundation of Business intelligence: Databases and information management. Telecommunication, The Internet and Wireless technology, Securing information systems: system vulnerability, Business value of security and control.

Unit IV	Key System Applications for Digital Age	(05hrs)	CO4
Enterprise Applications, E-Commerce: Digital Markets and Digital Goods, Managing knowledge, Enhancing Decision Making, Building information Systems, Managing project: The importance of project Management, the business value of information systems, Managing project risk, Managing Global Systems: The growth of international information systems, organizing international information systems, Technology issues and opportunities for global value chain.			
Unit V	**Business Applications**	**(05hrs)**	**CO5**
Introduction to e-business systems: Functional Business systems, cross functional Enterprise systems. Customer Relationship Management: The Business focus, Enterprise Resource Planning: The business backbone, Supply chain Management: Business Network. Electronic Commerce Systems: Fundamentals, e-commerce applications and issues. Decision support systems: Decision support in Business, DSS Components, Data Mining for Decision Support, benefits and challenges in enterprise system.			

Text Books

1. Waman S. Javadekar,"Management Information System: A Global Digital Enterprise Perspective", McGraw Hill Education Pvt. Ltd. 5th Edition, ISBN– 13:978-1-25-902669-0.
2. James A.O' Brien, George MMarakas, "Management Information Systems", The McGraw-Hill Companies, 7th Edition, ISBN-0-07-062-003-2

Reference Books

1. Kenneth C. Laudon, Jane P. Laudon, "Management information Systems: Managing the Digital Firm", Perason, 12th Edition, ISBN-978-81-317-8746-5.
2. James A. O'Brien," Management Information Systems: Managing information Technology in the Business Enterprise", Tata McGraw Hill Edition, 6th Edition, ISBN- 0-07-058739-6.
3. Robert Schultheis, Marry sumner, "Management information system: The Manager's View", Tata McGraw Hill Edition, 4th Edition, ISBN-0-07-463879-3.
4. Gordon B. Davis, Margrethe H. Olson, "Management Information Systems: Conceptual Foundations, Structure and Development", Tata McGraw Hill Edition, 2nd Editon,ISBN-13:978-0-07-040267-6

Strength of CO-PO / PSO Mapping														
	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2	1	1	-	-	-	-	-	-	-	-	1	2
CO2	1	1	1	-	-	-	-	1	1	-	-	-	1	1
CO3	2	1	1	-	-	-	-	-	-	-	-	-	2	1
CO4	2	1	1	1	-	-	-	-	-	-	1	-	2	1
CO5	2	2	2	1	1	-	-	-	-	-	-	-	2	2
Average	1.6	1.4	1.2	1	1	-	-	1	1	-	1	-	1.6	1.4

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-3 (Quiz 10 marks on each)	30
2	Theory assignment on Unit- 4 and 5 (10 marks assignment on unit 4 and 5)	20
	Total	50

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

T. Y. B. Tech. Computer Engineering
Pattern 2022 Semester: V
COM223009 Data Communication and Networking

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: - COM222003: Discrete Structures

Course Objectives:
- To introduce the fundamental various types of computer networks.
- To Analyze Data Communication
- To explore the various layers of OSI Model
- Explore Transport Layer Concepts
- Examine Application Layer Protocols

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

	Course Outcomes	**Bloom's Level**
CO1	Summarize fundamental concepts of Computer Networks, architectures, protocols and technologies	2-Understand
CO2	Illustrate the working and functions of data link layer	2-Understand
CO3	Analyze the working of different routing protocols and mechanisms	3-Apply
CO4	Understand Elements of Transport Layer Protocols	2-Understand
CO5	Illustrate role of application layer with its protocols, client-server architectures	2-Understand

COURSE CONTENTS

Unit I	**Data Communications**	**(06 hrs)**	**CO1**

Introduction to Data Communication, importance of data communication. Modes of Data Transmission, Signals and Modulation, Data Transmission Concepts(Bandwidth,Data,Rate,Latency), Data Transmission Modes, Error Detection and Correction, Protocols and Standards (e.g., TCP/IP, OSI model), Network Models(OSI,TCP/IP), Multiplexing, Media Access Control (MAC)

Unit II	**Data Link Layer**	**(08 hrs)**	**CO2**

Introduction, functions. Design Issues: Services to Network Layer, Framing, Addressing, Flow Control Protocall: Stop-and-Wait Protocol, The Go-Back-N ,Sliding Window Protocol, Automatic Repeat request (ARQ), Error Control, Address Resolution Protocol (ARP),L logical Link Control (LLC), Frame Synchronization, Fragmentation and Reassembly

Unit III	**Network Layer**	**(08hrs)**	**CO3**

Introduction: Functions of Network layer. Switching Techniques: Circuit switching, Message Switching, Packet Switching. IP Protocol: Classes of IP (Network addressing), IPv4, IPv6, Network Address Translation, Sub-netting, CIDR. Network layer Protocols: ARP, RARP, ICMP, IGMP. Network Routing and Algorithms: Static Routing, Dynamic Routing, Distance Vector Routing, Link State Routing, Path Vector. Routing Protocols: RIP, OSPF, BGP

Unit IV	**Transport Layer**	**(08hrs)**	**CO4**

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

Unit V	**Application Layer**	**(06hrs)**	**CO5**

Introduction, Web and HTTP, Web Caching, DNS, Email: SMTP, MIME,POP3, Webmail, FTP, TELNET,DHCP, SNMP, Client-Server Architecture, APIs and Interfaces, Authentication and Authorization, Error Handling and Recovery

Text Books

1. Data Communication and Networking by Behrouz A. Forouzan (Fourth Edition), Tata McGraw Hill
2. Computer Networks by Andrew S. Tanenbaum (Fifth Edition), Pearson Education

Reference Books

1. Kurose, Ross, “Computer Networking a Top Down Approach Featuring the Internet”,Pearson, ISBN-10: 0132856204
2. L. Peterson and B. Davie, “Computer Networks: A Systems Approach”, 5th Edition, Morgan-Kaufmann, 2012.

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	2	-	-	-	-	-	-	-	3	3	2
CO2	3	3	2	2	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	-	-	-	-	-	-	-	3	3	3
Average	3	3	2	2	-	-	-	-	-	-	-	3	3	3

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, (Quiz 15 marks each and will be converted to 15 Marks)	15
2	Theory assignment on Unit-3 and Unit 5	10
	Total	**20**

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

T. Y. B. Tech. Computer Engineering **Pattern 2022 Semester: V** **COM223010 : Project Based Learning**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical : 2 hrs./week **Tutorial: 1hr/Week**	**02**	**Termwork:25 Marks** **Tutorial : 25 Marks**
Prerequisite Courses: --		
Companion Course: --		

Course Objectives:

- To develop critical thinking and problem solving ability by exploring and finding solutions to social problem.
- To evaluate alternative approaches and justify the use of selected methods.
- To provide every student the opportunity to get involved either individually or as a group so as to develop team skills.

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

	Course Outcomes	**Bloom's Level**
CO1	Identify the real life problem from societal need point of view	3-Apply
CO2	Compare alternative approaches to select the most feasible method	4-Analyze
CO3	Develop the reliable and scalable solution to meet challenges	3-Apply
CO4	Develop communication skill through demonstration of their ideas	3-Apply

Guidelines for Laboratory Conduction

Selection of Project/Problem: The problem-based project oriented model for learning is recommended. The model begins with the identifying of a problem, often growing out of a question or "wondering". This formulated problem then stands as the starting point for learning. Students design and analyze the problem within an articulated interdisciplinary or subject frame. A problem can be theoretical, practical, social, technical, symbolic, cultural and/or scientific and grows out of students' wondering within different disciplines and professional environments. A chosen problem has to be exemplary. The problem may involve an interdisciplinary approach in both the analysis and solving phases. By exemplarity, a problem needs to refer back to a particular practical, scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry. There are no commonly shared criteria for what constitutes an acceptable project. Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content and structure of the activity.

- A few hands-on activities that may or may not be multidisciplinary
- Use of technology in meaningful ways to help them investigate, collaborate, analyze, synthesize and present their learning.
- Activities may include- Solving real life problem, investigation /study and Writing reports of in depth study, field work.

Group Structure:

Working in supervisor/mentor monitored groups; the students plan, manage, and complete a task/project/activity which addresses the stated problem.
1. There should be team/group of 4-5 students
2. A supervisor/mentor teacher assigned to individual groups

Guidelines for Student's Lab Journal

The laboratory work are to be submitted by students in the form of detailed documentation which may include requirements, design and modelling, implementation/execution, use of technology and other documents

Guidelines for Term work Assessment

Assessment:
Progress of PBL is monitored regularly on weekly basis. Weekly review of the work is necessary. During process of monitoring and continuous assessment and evaluation of the individual and the team performance is to be measured.
Group may demonstrate their knowledge and skills by developing a public product and/or report and/or presentation.
1. Individual assessment for each student (Understanding individual capacity, role and involvement in the project)
2. Group assessment (roles defined, distribution of work, intra-team communication and togetherness)
3. Documentation and presentation

Recommended parameters for assessment/evaluation and weightage:
1. Idea Inception and Awareness /Consideration of -Environment/ Social /Ethics/ Safety Measures /Legal aspects (15%)
2. Outcomes of PBL/ Problem Solving Skills/ Solution provided/ Final product (Individual Assessment and team assessment) (50%)
3. Documentation (Gathering requirements, design and modelling, implementation/execution, use of technology and final report, other documents) (15%)
4. Demonstration (Presentation, User Interface, Usability) (20%)

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	-	-	-	-	-	3	3	-	3	-	-
Average	3	3	2	-	-	-	-	-	3	3	-	3	-	-

K.K.Wagh Institute of Engineering Education and Research, Nashik
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T. Y. B. Tech. Computer Engineering **Pattern 2022 Semester: VI** **COM223011 : Data Science and Big Data**		
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: - COM223003 : Database Management System

Companion Course:- COM223013: Data Science and Big data Lab

Course Objectives:

- To understand the data analytics life cycle
- To study big data characteristics and preprocessing techniques
- To get familiar with supervised and unsupervised learning algorithm

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

	Course Outcomes	**Bloom's Level**
CO1	Illustrate various data pre-processing techniques to simplify and speed up machine learning algorithms	2-Understand
CO2	Compare various regression algorithms	2-Understand
CO3	Compare different classification algorithms.	2-Understand
CO4	Compare different clustering algorithms.	2-Understand
CO5	Describe data analytics life cycle	2-Understand

COURSE CONTENTS

Unit I	**Feature Engineering**	**(09 hrs)**	**CO1**

Concept of Features, **preprocessing of data:** Normalization and Scaling, Standardization, Managing missing values,
Dimensionality Reduction, Feature Extraction: Principal Component Analysis(PCA), Kernel PCA, Local Binary Pattern. Feature Selection Techniques: Sequential Forward Selection, Sequential Backward Selection. Multidimensional Scaling, Matrix Factorization Techniques.

Unit II	**Regression**	**(06 hrs)**	**CO2**

Regression: Bias, Variance, Generalization, Underfitting, Overfitting, Linear regression, Logistic regression, Lasso regression, Ridge regression
Evaluation Metrics: MAE, RMSE, R2.

Unit III	**Classification**	**(09 hrs)**	**CO3**

Classification: K-nearest neighbor, Support vector machine, Decision Tree
Ensemble Learning: Bagging, Boosting, Adaboost. Binary-vs-Multiclass Classification, Balanced and Imbalanced Multiclass Classification Problems, Variants of Multiclass Classification: One-vs-One and One-vs-All
Evaluation Metrics: Accuracy, Precision, Recall, Fscore, Cross-validation.

Unit IV	**UnSupervised Learning**	**(06 hrs)**	**CO4**

Cluster Analysis, Partition Methods: K-Means, K-Medoids. Hierarchical Methods: Agglomerative and

Divisive Hierarchical Clustering. Dynamic Clustering, Multi-view Clustering.
Measuring Clustering Quality

Unit V	**Big Data and Analytics**	**(06 hrs)**	**CO5**

Data explosion, Sources of Big Data, Big Data Characteristics.
Data Analytic Lifecycle: Introduction, Phase 1: Discovery, Phase 2: Data Preparation, Phase 3: Model Planning, Phase 4: Model Building, Phase 5: Communication results, Phase 6: Operationalize.

Text Books

1. Jiawei Han, Micheline Kamber, and Jian Pie, "Data Mining: Concepts and Techniques" Elsevier Publishers Third Edition, ISBN: 9780123814791, 9780123814807
2. David Dietrich, Barry Hiller, "Data Science and Big Data Analytics", EMC education services, Wiley publication, 2012, ISBN0-07-120413-X

Reference Books

1. EMC Education Services, "Data Science and Big Data Analytics- Discovering, analyzing Visualizing and Presenting Data"
2. 2. DT Editorial Services, "Big Data, Black Book", DT Editorial Services, ISBN: 9789351197577, 2016 Edition
3. Chirag Shah, "A Hands-On Introduction To Data Science", Cambridge University Press, (2020), ISBN : ISBN 978-1-108-47244-9
4. Wes McKinney, "Python for Data Analysis ", O' Reilly media, ISBN: 978-1-449-31979-3

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	-	3	-	-	-	-	-	-	-	3	3	-
CO2	3	3	-	3	-	-	-	-	-	-	-	3	3	-
CO3	3	3	-	3	-	-	-	-	-	-	-	3	3	-
CO4	3	3	-	3	-	-	-	-	-	-	-	3	3	-
CO5	3	3	-	3	-	-	-	-	-	-	-	3	3	-
Average	3	3	-	3	-	-	-	-	-	-	-	3	3	-

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Quiz on Unit I, Unit II and Unit III each of 10 marks (Total marks will be converted to 10 marks)	10
2	Assignment on Unit IV and Unit V each of 10 marks (Total marks will be converted to 10 marks)	10
	Total	**20**

K.K.Wagh Institute of Engineering Education and Research, Nashik
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T. Y. B. Tech. Computer Engineering
Pattern 2022 Semester: VI
COM223012: Theory of Computation

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: - COM222003: Discrete Mathematics

Companion Course: -

Course Objectives:

- To introduce the students about the basic concepts of formal language, natural language and finite state machines.
- To study abstract computing models to provide a formal connection between algorithmic problem solving and the theory of languages
- To understand Grammar, Pushdown Automata and Turing Machine for language processing and algorithm design
- To learn about the theory of computability and complexity for algorithm design

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

	Course Outcomes	**Bloom's Level**
CO1	Construct finite automata and regular expression, for given regular language and their inter conversion.	2-Understand
CO2	Classify between pumping lemma for regular expression and Context Free Grammar.	2-Understand
CO3	Construct Context Free Grammars and convert a given grammar in one form to other form	3-Apply
CO4	Construct Pushdown Automata for the given Context Free language	3-Apply
CO5	Construct Turing Machine for regular and non regular languages and understand the concept of different classes of problems	3-Apply

COURSE CONTENTS

Unit I	**Formal Language Theory and Finite Automata**	**(09 hrs)**	**CO1**

Basic Concepts: Symbols, Strings, Language, Formal Language, Natural Language. Basic Machine and Finite State Machine.
Finite Automata (FA): An informal picture of FA, Finite State Machine (FSM), Language accepted by FA, Definition of Regular Language.
FA without output: Deterministic and Nondeterministic FA (DFA and NFA), epsilon- NFA and inter-conversion.
FAwithoutput:MooreandMealymachines-Definition,models,inter-conversion

Unit II	**Regular Expressions**	**(06 hrs)**	**CO2**

Introduction, Operators of RE, Precedence of operators, Algebraic laws for RE, Language to Regular Expressions, Equivalence of two REs.
Conversions: RE to NFA, DFA, DFA to RE using Arden's theorem, Pumping Lemma for Regular languages, Closure and Decision properties of Regular languages
Case study: To study the use of RE in text processing systems for pattern matching

Unit III	Context Free Grammar (CFG)and Context Free Language (CFL)	(07hrs)	CO3

Basic Elements of Grammar, Formal Definition of Context Free Grammar, Sentential form, Derivation and Derivation Tree/ Parse Tree, Context Free Language (CFL), Ambiguous Grammar, writing grammar for language.

Simplification of CFG: Eliminating Є-productions, unit productions, useless production, and useless symbols.

Normal Forms: Chomsky Normal Form, Greibach Normal Form, Pumping Lemma for CFG, Closure properties of CFL

Unit IV	Pushdown Automata	(07hrs)	CO4

Introduction, Formal definition of PDA, Equivalence of Acceptance by Final State and Empty stack, Non-deterministic PDA (NPDA), PDA and Context Free Language, Equivalence of PDA and CFG, PDAvs CFLs. Deterministic CFLs.

Unit V	Turing Machines	(07hrs)	CO5

Introduction, Formal definition of Turing Machines, Language Acceptability by Turing Machines, Universal Turing Machines, Multi-Tape Turing Machines, Multi-Stack Turing Machines, Multi-Track Turing Machines, Halting Problem of TM, Recursion Theorem

Complexity Classes: The Class P, The Class NP, Examples of problems in NP, NP-hard Problems.

Case Study : To study the use of Application of Halting problem in parallel computing

Text Books

1. Vivek Kulkarni, “Theory of Computation”, Oxford University Press, ISBN0-19-808458
2. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, “Introduction to Automata Theory Languages and Computation”, Addison-Wesley, ISBN 0-201-44124-1
3. Daniel Cohen, “Introduction to Computer Theory”, Wiley & Sons,ISBN97881265133454

Reference Books

1. Sanjeev Aroraand Boaz Barak, “Computational Complexity: A Modern Approach”, Cambridge University Press, ISBN: 0521424267 97805214242643
2. John Martin, “Introduction to Languages and The Theory of Computation”, 2nd Edition, McGraw Hill Education,ISBN-13:978-1-25-900558-9, ISBN-10: 1-25-900558-5

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	-	-	-	-	-	-	-	-	-	-	-	-	-

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 each of 15 marks (Total marks will be converted to 15 out of 60 Marks)	15
2	Theory assignment on Unit-3 (One Assignment on Unit-3 of 15 marks will be converted to 5 Marks)	05
	Total	**20**

K.K.Wagh Institute of Engineering Education and Research, Nashik
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T. Y. B. Tech. Computer Engineering
Pattern 2022 Semester: VI
COM223013: Data Science and Big Data Analytics Lab

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

Prerequisite Courses: - COM223004 : Database Management Systems Lab

Companion Course:- COM223011: Data Science and Big Data

Course Objectives:

- To study data preprocessing techniques
- To compare performance of various classification algorithms
- To make use of clustering algorithms
- To develop a regression model and verify its performance

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

	Course Outcomes	**Bloom's Level**
CO1	Make use of data pre-processing techniques to simplify and speed up machine learning algorithms	3-Apply
CO2	Analyze the performance of classification algorithms for given datasets	4-Analyze
CO3	Analyze the performance of clustering algorithms for given datasets	4-Analyze
CO4	Analyze the performance of regression algorithms for given datasets	4-Analyze

List of Laboratory Experiments / Assignments

Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	For any five Datasets available in WEKA's Data directory, Load the Datasets one at a time using "Explorer" and fill-in the following table	**CO1**

Sr. No.	**Name of the Dataset**	**No. of Instances**	**No. Of Attributes**	**Type of Attributes (Numeric, Nominal or both)**	**Suitable for (Classification/Prediction, Clustering)**

Perform Classification on datasets available under WEKA's Data subfolder using J48, Bays, Neural Network and Lazy Classifiers (Do not

<table>
<tr>
<td></td>
<td>change any default values for any of the classifiers. For Lazy Classifier use LWL by setting the appropriate parameter).
Use Train Set and Cross validation with 10 folds. Record your reading for each dataset as follows
<table>
<tr><th>Sr. No.</th><th>Name of the Dataset</th><th>No. of Instances</th><th>No. Of Attributes</th><th colspan="4">Accuracy using (SVM, KNN, Decision Tree)</th><th colspan="4">Time required for Classification Using (SVM, KNN, Decision Tree)</th></tr>
<tr><td colspan="4">AVG Accuracy and Time</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
Write your comments about Accuracy and time required for these classifiers

c. Repeat experiment 2 b) above but this time using WEKA's Supervised Attribute filter, "Attribute Selection" and record your observations as given below and comment on the observations.
<table>
<tr><th>Sr. No.</th><th>Name of the Dataset</th><th>No. of Instances</th><th>No. Of Attributes</th><th>No. of Attr after applying Filter</th><th colspan="4">Accuracy using (SVM, KNN, Decision Tree)</th></tr>
<tr><td colspan="5">AVG Accuracy</td><td></td><td></td><td></td><td></td></tr>
</table>
d. Repeat the experiment 2b) above but this time apply WEKA's in-built Instance Filter (Use "RemoveMissedClassified" filter) on original datasets and record your observations as given above only the 5th column will be titled as "No. of Instances after applying filter". Fill-in the observations and write comments
e. Repeat the above experiment 2b) but this time by applying both Attribute as well as Instance filter, fill-in the table and write your comments.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Perform the following operations using Python on any open source dataset

1. Import all the required Python Libraries.
2. Locate open source data from the web (e.g. https://www.kaggle.com). Provide a clear description of the data and its source (i.e., URL of the web site).
3. Load the Dataset into the pandas data frame.
4. Display the initial statistics.
5. Scan all variables for missing values and inconsistencies. If there are missing values and/or inconsistencies, use any of the suitable techniques to deal with them.
6. Scan all numeric variables for outliers. If there are outliers, use any of the suitable techniques to deal with them.
7. Apply data transformations on at least one of the variables.
8. Turn categorical variables into quantitative variables in Python.</td>
<td>CO1</td>
</tr>
<tr>
<td>3</td>
<td>Implement PCA Feature extraction technique on any data set</td>
<td>CO1</td>
</tr>
<tr>
<td>4</td>
<td>Create a Linear Regression Model using Python/R to predict home</td>
<td>CO4</td>
</tr>
</table>

	prices using Boston Housing Dataset (https://www.kaggle.com/c/boston-housing).	
5	Implement **logistic regression** using Python/R to perform classification on Social_Network_Ads.csv dataset. Evaluate the model	CO4
6	Classify the email using the binary classification method. Email Spam detection has two states: a)Normal State – Not Spam, b) Abnormal State – Spam. Use **Support Vector Machine** classification algorithm for classification. Analyze its performance. Dataset: The emails.csv dataset on the Kaggle https://www.kaggle.com/datasets/balaka18/email-pam-classification-dataset-csv	CO2
7	Implement **KNN** classification algorithm using Python/R on iris.csv dataset. Compute Confusion matrix to find TP, FP, TN, FN, Accuracy, Error rate, Precision, Recall on the given dataset.	CO2
8	Implement **K-Means clustering** on a dataset. Determine the number of clusters using the elbow method. Dataset: https://www.kaggle.com/datasets/kyanyoga/sample-sales-data or any dataset of your choice	CO3
10	Develop a mini project for any data science application using any machine learning model.use Python/R for implementation.	CO1-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: - Python

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 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)

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	-	-	3	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	3	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	3	-	-	-	-	-	-	-	-	-
Average	3	2.75	-	-	3	-	-	-	-	-	-	-	-	-

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T. Y. B. Tech. Computer Engineering
Pattern 2022 Semester: VI
COM223014A: User Interface and User Experience Design

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: - COM222006 : Design Thinking

Course Objectives:

- To learn the factors that determine how people use technology
- To explore the challenges associated with information visualization and its societal and individual impacts.
- To learn usability evaluation methods

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

	Course Outcomes	**Bloom's Level**
CO1	Explain the principles of user interface	2-Understand
CO2	Outline user experience phases	2-Understand
CO3	Identify strategies for managing design projects	3-Apply
CO4	Apply the quality of service and data visualization	3-Apply
CO5	Test for the usability of a design through usability evaluations	4-Analyze

COURSE CONTENTS

Unit I	**Introduction and Overview of UI**	**(08 hrs)**	**CO1**

The Human– I/P, O/P channels, Human Memory, thinking, emotion, individual difference (diversity), human psychology

Introduction to User Interface Design (UI) -The Relationship Between UI and UX , Roles in UI/UX, A Brief historical Overview of Interface Design, Interface Conventions, Approaches to Screen Based UI, Template vs Content, Formal Elements of Interface Design, Active Elements of Interface Design, Composing the Elements of Interface Design, UI Design Process, Visual Communication design component in Interface Design , Application of UI design

Introduction to Design Technologies and Tools Sketch ,Wireframe ,Invision, Axure, Figma, Flutter, Mockups

Unit II	**User Experience**	**(07 hrs)**	**CO2**

UX Basics- Foundation of UX design, Good and poor design, Understanding Your Users, Designing the Experience Elements of user Experience, Visual Design Principles, Functional Layout, Interaction design, Introduction to the Interface, Navigation Design, User Testing, Developing and Releasing Your Design
User experience and user interaction-Usability of interactive systems, goals and measures, Universal Usability, Characteristics of graphical and web user interfaces, guidelines, principles and theories of good design
User Experience- Concept of UX, Trends in UX, 6 Stages used to UX design , Applications of UX design

Unit III	**Design Process**	**(07 hrs)**	**CO3**

Managing design processes, organizational design to support usability, pillars of design, development methodologies, Human considerations in Design
Usability- principles to support usability, assessment in the design process, Usability problems, practical measures of usability,objective measures of usability, golden rules of interface design
Evaluating Interface Design– Introduction, Expert reviews, Usability testing, Acceptance tests, Legal issues

Unit IV	**Interaction Styles and controls**	**(07 hrs)**	**CO4**

Interaction Styles-
Direct manipulation and virtual environment, Develop system menus and navigation schemes-Structure of menus, Function of menus, content of menus, phrasing the menu, navigating menus, kinds of graphical menus, form fill-in and dialog boxes, command- organization , functionality, strategies and structure, naming and abbreviations, interaction devices, collaboration and social media participation.
Implementation support and Screen Based Controls

Unit V	**Usability Evaluation and Design Issues**	**(07 hrs)**	**CO5**

Quality of service- Models of response time impacts, user productivity, variability in response time, Balancing function and fashion- Error messages, display design, web page design, window design, color,
Information visualization– data type by task taxonomy, challenges for information visualization, societal and individual impact of user interface
Usability Evaluation Methods-
Usability Testing ,Heuristic evaluations , Cognitive walkthrough, Surveys and Questionnaires Eye Tracking, A/B Testing, Remote Usability Testing, Think-Aloud Protocol, Comparative Usability Evaluation Industry Trends and Case Studies, Professional practices and career opportunities in UI/UX design

Text Books

1. Creative Tim ,"Fundamentals of Creating a Great UI/UX", First Edition
2. Jon Yablonski, "Laws of UX: Using Psychology to Design Better Products & Services" , O'Reilly Media, Inc.", 21-Apr-2020 , First Edition
3. Jenifer Tidwell, Charles Brewer, Aynne Valencia "Designing Interfaces: Patterns for Effective Interaction Design", O'Reilly Media, Inc.", First Edition

Reference Books

1. Shneiderman, Plaisant, Cohen, Jacobs, "Designing the User Interface-Strategies for Effective Human Computer Interaction", 5th Edition ,PEARSON Publication, ISBN 97881317-3255-7
2. Wilbert O. Galitz "The Essential Guide to User Interface Design", 2nd Edition, WILEY Publication, 9780471271390, 047127139X
3. Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, "Human–Computer Interaction, 3rd Edition, PEARSON education , 9788131717035, 8131717038
4. Alan Coopen, "The essentials of interaction", Wiley , ISBN:9781568843223, 156884322

e-Books

1. "The Guide to Wireframing" by UXPin: https://www.uxpin.com/studio/ebooks/guide-to-wireframing/ - This eBook provides an in-depth guide to wireframing, covering the basics, best practices, and tips for creating effective wireframes.
2. "UX Design for Startups" by Marcin Treder: https://uxpin.com/studio/ebooks/ux-design-for-startups/ - This eBook focuses on UX design principles and strategies specifically tailored for startups, covering topics like user research, prototyping, and user testing.

MOOC Courses links

- https://onlinecourses.nptel.ac.in/noc21_ar05/preview

Strength of CO-PO/PSO Mapping														
	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	-	-	-	-	-	2	-	-	-	1	1	2
CO2	2	2	-	-	-	-	-	2	-	-	-	1	1	2
CO3	3	1	3	-	-	-	-	2	-	-	-	1	1	-
CO4	2	1	3	-	-	-	-	2	-	-	-	1	1	-
CO5	2	2	3	-	-	-	-	2	-	-	-	1	1	-
Average	2.66	1.28	1.50	-	-	-	-	2	-	-	-	1	1	2

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 Each of 15 marks (Total marks will be converted to 15 Marks)	15
2	Theory assignment on Unit-3 of 15 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)

T. Y. B. Tech. Computer Engineering
Pattern 2022 Semester: VI
COM223014B: Generative AI and Prompt Engineering

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: -
2311302- Artificial Intelligence

Course Objectives:

- To understand the fundamentals of Generative Adversarial Networks (GANs).
- To acquire knowledge on how to use Generative AI techniques in software development.
- To understand language model architectures, training methods.
- To study the role of prompt engineering in NLP model development.

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

	Course Outcomes	**Bloom's Level**
CO1	Explain the fundamentals of Generative Adversarial Networks (GANs)	2- Understand
CO2	Identify role of Large Language Model for text generation	3- Apply
CO3	Identify the role of NLP within AI contexts	3- Apply
CO4	Make use of prompt engineering in advancements in NLP	2- Understand
CO5	Illustrate the techniques and Application for Prompt Engineering	2- Understand

COURSE CONTENTS

Unit I	**Introduction to Generative AI**	**(06 hrs)**	**CO1**

Generative Adversarial Networks (GANs) Fundamentals, Introduction Generative AI Models, Ethical Considerations for using AI, Applications of Generative AI in Different Industries.

Unit II	**Large Language Models (LLM) for Text Generation**	**(08 hrs)**	**CO2**

Vector Representations, Transformer Architecture, Probabilistic Text Generation, The Rise of Transformer Architectures, OpenAI's Generative Pre-Trained Transformers GPT-3.5-turbo and ChatGPT GPT-4 Google's Gemini Meta's LLaMA

Unit III	**Natural Language Processing (NLP)**	**(08hrs)**	**CO4**

Introduction to NLP, Language Models, Statistical Model (n-Grams), Knowledge based Models, Contextual language Models, Neural Network Based Models, Transformer Models.

Unit VI	**Prompt Engineering**	**(08hrs)**	**CO3**

Introduction to prompt engineering, Principles of Effective Prompts, Crafting Compelling Prompts, Generative Pre-trained Transformers (GPT) models, API usage vs. web interface, Tokens, Costs, tokens and initial prompts: how to calculate the cost of using a model, Understanding the API parameters, Databases, Retrieval

Unit V	Prompt Engineering Techniques & Applications	(06hrs)	CO5

Prompt Engineering Techniques- Zero shot & Few shot prompting, Chain of thought (COT), Automatic Chain of Thought (Auto- COT), Chain- of- Symbol (CoS), Tree- of- Thoughts (ToT), Graph of thoughts (GoT), Chain-of- Verification (CoVe), Chain- of- code (CoC), Application: Question-Answering Systems, Conversational AI, Sentiment Analysis, Template-Based Prompt Generation, Text Augmentation.

Text Books

1. Ethan James Whitfield , “Generative AI for Beginners”, Independently published, ISBN-13 : 979-8869928337
2. James Phoenix, Taylor, “Prompt Engineering for Generative AI”, O'Reilly Media, Inc., ISBN: 9781098153434
3. Aymen El Amri, Leanpub, “LLM Prompt Engineering for Developers”, Independently published, ISBN-13: 979-8859940714

Reference Books

1. Robert E. Miller, “Prompt Engineering Bible: Join and Master the AI Revolution”, Independently Published, ISBN-13: 979-8861782944
2. Hobson Lane, Hannes Hapke, and Cole Howard, “Natural Language Processing in Action: Understanding, analyzing, and generating text with Python”, Manning Publications,1st Edition, ISBN-13: 978-1617294631
3. Scikit-Learn, Keras, and Tensor Flow, “Hands-On Machine Learning”, O'Reilly Media, 2nd Edition. ISBN-13: 978-9352139057
4. François Chollet, “Deep Learning with Python”, Manning Publications, 2nd Edition, ISBN 9781617296864
5. Steven Bird, Ewan Klein, and Edward Loper, “Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit", O'Reilly Media, ISBN-10: 8184047487
6. Nathan Hunter, "The Art of Prompt Engineering with ChatGPT: A Hands-On Guide", Independently Published, 3rd Edition, ISBN-13: 978-1739296711

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	-	3	2	-	-	-	-	-	-	-	-
CO2	-	-	-	-	3	2	-	-	-	-	-	-	-	-
CO3	-	-	-	-	3	2	-	-	-	-	-	-	-	-
CO4	-	-	-	2	3	2	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	2	-	-	-	-	-	-	-	-
Average	-	-	-	2	3	2	-	-	-	-	-	-	-	-

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, Unit- 4 and 5 (Quiz 10 marks on each unit and will be converted to 10 Marks)	20

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

T. Y. B. Tech. Computer Engineering Pattern 2022 Semester: VI COM223014C: High Performance Databases		
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: - COM2301303: Database Management Systems

Companion Course :- COM2301316 Program Elective Course II + Program Elective Course Lab III Lab

Course Objectives:

- To understand the Principles of Database Performance Optimization
- To know high performance database storage and retrieval process
- To study to analyze Database Performance Metrics

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

	Course Outcomes	**Bloom's Level**
CO1	Illustrate the Principles of Database Performance Optimization	2-Understand
CO2	Design Scalable Database Architecture	3-Apply
CO3	Make use of Indexing and query optimization techniques to improving query performance	3-Apply
CO4	Apply advanced concurrency control and transaction management techniques to optimize the performance of database systems	3-Apply
CO5	Analyze and Evaluate Database Performance Metrics	4- Analyze

COURSE CONTENTS

Unit I	**Fundamentals of High-Performance Databases**	**(06 hrs)**	**CO1, CO2**

Introduction to high-performance databases: Definition, importance, and challenges,
Key performance metrics: Throughput, latency, scalability, and concurrency.
Characteristics comparison of high-performance databases with traditional databases.

Unit II	**Database Architecture and Design for Performance**	**(08 hrs)**	**CO2**

Database architecture principles for performance optimization.
Storage optimization techniques: File organization, compression, and partitioning.
Memory management strategies: Caching, buffering, and efficient data retrieval.
Introduction to distributed database architectures and their role in achieving high performance

Unit III	**Indexing, Query Optimization, and Scaling**	**(08 hrs)**	**CO3**

Indexing and Hashing techniques for improving query performance : Basic Concepts, Btree and B+-Tree Index Files, Static and Dynamic Hashing
Query optimization : strategies and execution plans
Scaling & Replication: Horizontal and vertical scaling methods for handling increased workloads.

Overview of database replication techniques for high availability and fault tolerance			
Unit IV	**Advanced Transaction Processing**	**(08 hrs)**	**CO4**
Transaction-Processing: Monitors, TransactionalWorkflows, E-Commerce, Main-Memory Databases, Real-Time Transaction Systems, Long-Duration Transactions Understanding in-memory databases and their benefits			
Unit V	**Performance Monitoring**	**(06 hrs)**	**CO5**
Performance Monitoring and Tuning: Performance Metrics and Monitoring Tools, Strategies for performance tuning and optimization, Query Tuning and Optimization Techniques **Application Design and Development** - Application programs and Interfaces, Application Architecture, RAD (Rapid application Development), Application Performance, Application Security **Case Studies and Real-World Applications** such as Case studies on handling large-scale data in various domains (e.g., social media, finance, e-commerce)			

Text Books

1. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", 6 th Edition Tata McGraw Hill Publishers, ISBN 0-07-120413-X.
2. Baron Schwartz, Peter Zaitsev, and Vadim Tkachenko , "High Performance MySQL: Optimization, Backups, and Replication", O′Reilly , ISBN-1449314287

Reference Books

1. Martin Kleppmann , "Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems", O′Reilly, ISBN 1449373321
2. Alex Petrov , "Database Internals: A Deep Dive into How Distributed Data Systems Work" Kindle edition, ISBN **978-1492040347**

Strength of CO-PO/PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	-	2	-	-	-	-	-	-	-	-	3	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	2	2
CO3	3	2	3	2	-	-	-	-	-	-	-	-	2	-
CO4	2	3	3	2	-	-	-	-	-	-	-	-	-	2
CO5	2	2	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	2	3.	2	3	-	-	-	-	-	-	-	2.	2.

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, Unit 4 (Quiz 15 marks each and will be converted to 15 Marks)	15
2	Theory assignment on Unit-5 (One Assignment on 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)

T. Y. B. Tech. Computer Engineering
Pattern 2022 Semester: VI
COM223015A: Cloud Computing

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: - COM223008 Data Communication and Computer Networks

Course Objectives:

- To understand the concepts of Cloud Computing.
- To learn Taxonomy of Virtualization Techniques.
- To learn Cloud Computing Architecture.
- To acquire knowledge on various Cloud Application Platform.

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

	Course Outcomes	**Bloom's Level**
CO1	Understand the different Cloud Computing environment	2-Understand
CO2	Use appropriate data storage technique on Cloud, based on Cloud application	2-Understand
CO3	Analyze virtualization technology and install virtualization software	2-Understand
CO4	Develop and deploy applications on Cloud	3-Apply
CO5	Apply security providing techniques for cloud applications	3-Apply

COURSE CONTENTS

Unit I	**Introduction**	**(06 hrs)**	**CO1**

Importance of Cloud Computing, Characteristics, Pros and Cons of Cloud Computing, Migrating into the Cloud, Seven-step model of migration into a Cloud, Trends in Computing. Cloud Service Models: SaaS, PaaS, IaaS, Storage. Cloud Architecture: Cloud Computing Logical Architecture, Developing Holistic Cloud Computing Reference Model, Cloud System Architecture, Cloud Deployment Models

Unit II	**Data Storage and Cloud Computing**	**(08 hrs)**	**CO2**

Data Storage: Introduction to Enterprise Data Storage, Direct Attached Storage, Storage Area Network, Network Attached Storage, Data Storage Management, File System, Cloud Data Stores, Using Grids for Data Storage. Cloud Storage: Data Management, Provisioning Cloud storage, Data Intensive Technologies for Cloud Computing. Cloud file system (gfs and hdfs), Distributed Data Storage

Unit III	**Virtualization in Cloud Computing**	**(08hrs)**	**CO3**

Introduction: Definition of Virtualization, Adopting Virtualization, Types of Virtualization, Virtualization Architecture and Software, Virtual Clustering, Virtualization Application, Pitfalls of Virtualization. Virtualization in Grid, Virtualization in Cloud, Virtualization and Cloud Security. Virtualization and Cloud Computing: Anatomy of Cloud Infrastructure, Virtual infrastructures, CPU Virtualization, Network and Storage Virtualization.

Unit IV	**Cloud Platforms and Cloud Applications**	**(08hrs)**	**CO4**

Amazon Web Services (AWS): Amazon Web Services and Components, Amazon Simple DB, Elastic Cloud Computing (EC2), Amazon Storage System, Amazon Database services (Dynamo DB). Cloud Computing Applications: ECG Analysis in the Cloud, Protein Structure Prediction, Satellite Image Processing, CRM and ERP, Social Networking, Google App Engine. Overview of OpenStack architecture.

Unit V	**Security in Cloud Computing**	**(08hrs)**	**CO5**

Risks in Cloud Computing, Types of Risks in Cloud Computing, Risk Management, Enterprise-Wide Risk Management,Data Security in Cloud: Security Issues, Challenges, advantages, disadvantages, Cloud Digital persona and Data security, Content Level Security. Cloud Security Services: Confidentiality, Integrity and Availability, Security Authorization Challenges in the Cloud,Secure Cloud Software Requirements, Secure Cloud Software Testing, Cloud Security Audit

Text Books

1. A. Srinivasan, J. Suresh, "Cloud Computing: A Practical Approach for Learning and Implementation", Pearson, ISBN: 978-81-317-7651-3
2. Gautam Shrof "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications", Cambridge University Press, ISBN: 9780511778476

Reference Books

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing",
2. Dr. Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more", Wiley Publications, ISBN: 978-0-470-97389-9
3. Tim Mather, Subra K, Shahid L.,"Cloud Security and Privacy", Oreilly, ISBN-13 978-81-8404-815-5
4. Dr. Kumar Saurabh, "Cloud Computing, 4ed: Architecting Next-Gen Transformation Paradigms", Wiley publication, ISBN: 9788126570966
5. Rishabh Sharma, "Cloud Computing: Fundamentals, Industry Approach and Trends", Wiley publication

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	2	-	-	-	-	-	-	-	3	3	2
CO2	3	3	2	2	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	-	-	-	-	-	-	-	3	3	3
Average	3	2.8	2.8	2	-	-	-	-	-	-	-	3	3	2.8

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, (Quiz 15 marks each and will be converted to 15 Marks)	15
2	Theory assignment on Unit-3 and Unit 5	10
	Total	**20**

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

T. Y. B. Tech. Computer Engineering
Pattern 2022 Semester: VI
COM223015B: Natural Language Processing

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: -COM223002: Artificial Intelligence

Course Objectives:
- To study natural language processing & understanding.
- To learn the stages in natural language processing.
- To be familiar with the natural language generation.
- To understand application of natural language processing.

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

	Course Outcomes	**Bloom's Level**
CO1	Explain the fundamentals of natural language processing.	2-Understand
CO2	Apply syntactic analysis on natural language.	3-Apply
CO3	Apply semantic analysis on natural language.	3-Apply
CO4	Analyze the natural language text based on relations and knowledge.	3-Apply
CO5	Describe the applications of natural language processing.	2-Understand

COURSE CONTENTS

Unit I	**Introduction to Natural Language Processing**	**(06 hrs)**	**CO1**

NLP in the real world, NLP tasks, What is Language? Building block of Language, Why is NLP Challenging? Study of Language, Applications of Natural Language Processing, Evaluating Language Understanding systems, Different levels of Language Analysis, Representation & Understanding, The Organization of Natural Language Understanding systems.

Unit II	**Word Level Analysis & Syntactic Analysis**	**(08 hrs)**	**CO2**

Word Level Analysis: Regular Expressions- Finite-State Automata-Morphological Parsing-Spelling Error Detection and Correction-Words and Word Classes-Part-of Speech Tagging
Linguistic Background: An outline of English syntax, Grammars & Parsing, Features & Augmented Grammars, Grammars for Natural Language, Toward Efficient Parsing, Ambiguity Resolution: Statistical Methods.
Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.

Unit III	**Semantic Analysis**	**(08 hrs)**	**CO3**

Semantic & Lexical form, Linking Syntax & Semantics, Ambiguity Resolution, Other Strategies for Semantic Resolution, Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation.
Discourse Processing: Introduction, Cohesion, Reference Resolution, Discourse Coherence and Structure.

Unit IV	Text Processing, Context and World Knowledge	(08 hrs)	CO4

Basics of Knowledge Representation: Predicate Calculus, Knowledge Representation & Reasoning, Local Discourse Context & Reference, Using World Knowledge, Discourse Structure, Defining a Conversational Agent, Structured knowledge Representation.

Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation.

Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labelling, learning to Annotate Cases with Knowledge Roles and Evaluations.

Unit V	Information Retrieval & Applications of NLP	(08 hrs)	CO5

Information Retrieval: Design features of Information Retrieval Systems-Classical, non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net-Stemmers-POS Tagger- Research Corpora.

Model: Introduction to iSTART.

Information Extraction, Machine translation, Text Generation, Question Answering & Information Retrieval, Chatbots & Dialogue Systems, Automatic Speech recognition & Text-to-Speech.

Text Books

1. Allen James, "Natural Language Understanding", Pearson India, 2nd Edition ISBN: 9788131708958, 8131708950
2. U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
3. Anne Kao and Stephen R. Poteet (Eds), "Natural Language Processing and Text Mining", Springer-Verlag London Limited 2007

Reference Books

1. Jacob Eisenstein "Introduction to Natural Language Processing", MIT Press, ISBN: 9780262042840, 0262042843
2. James H. Martin, Daniel Jurafsky, "Speech and Language Processing" Pearson 1st Edition, ISBN 9789332518414

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	-
CO4	3	3	-	3	3	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3
Average	3	3	3	3	3	-	-	-	-	-	-	-	3	3

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 each of 10 marks (Total marks will be converted to 10 Marks)	10
2	Theory assignment on Unit 4, Unit 5 each of 10 marks (Total marks will be converted to 10 Marks)	10
	Total	**20**

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

T. Y. B. Tech. Computer Engineering
Pattern 2022 Semester: VI
COM223015C: High Performance Computing

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 Structure, COM222014: Computer Architecture

Companion Courses:- COM223016C:High Performance Computing laboratory

Course Objectives:

- To understand different parallel programming models
- To analyze the performance and modeling of parallel programs
- To illustrate the various techniques to parallelize the algorithm
- To study parallel communication operations.
- To discriminate CUDA Architecture and its components.

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

	Course Outcomes	**Bloom's Level**
CO1	Explain the scope of parallel computing and architectures	2-Understand
CO2	Interpret parallel algorithm principles and models	2-Understand
CO3	Illustrate data communication operations on various parallel architecture	2-Understand
CO4	Identify performance parameter for parallel computing system	3. Apply
CO5	Explain CUDA architecture & its applications in parallel programming	2. Understand

COURSE CONTENTS

Unit I	**Parallel Computing**	**(08 hrs)**	**CO1**

Parallel Computing : Motivation and Scope
Parallel Programming Platforms: Implicit Parallelism, Trends in Microprocessor and Architectures, Limitations of Memory, System Performance, Dichotomy of Parallel Computing Platforms, Communication Costs in Parallel Machines, Scalable design principles,
Architectures: N-wide superscalar architectures, Multi-core architecture.

Unit II	**Parallel Algorithm Design**	**(08 hrs)**	**CO2**

Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing
Parallel Algorithm Models: Data model, Task model, Work Pool model and Master Slave Model,
Complexities: Sequential and Parallel Computational Complexity

Unit III	Parallel Communication	(06hrs)	CO3

Basic Communication Operations: One-to-All Broadcast, All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter, Gather, All-to-All Personalized Communication, Circular Shift,

Unit IV	Analytical Modeling of Parallel Programs	(08hrs)	CO4

Analytical Models: Sources of overhead in Parallel Programs, Performance Metrics for Parallel Systems, The effect of Granularity on Performance
Matrix Computation: Matrix-Vector Multiplication, Matrix-Matrix Multiplication.
Parallel Search Algorithms: Depth First Search(DFS), Breadth First Search(BFS),
Parallel Sorting: Bubble sort and Merge sort

Unit V	CUDA Architecture	(06hrs)	CO5

Introduction to GPU: Introduction to GPU Architecture overview, Introduction to CUDA C- CUDA programming model, write and launch a CUDA kernel, Handling Errors, CUDA memory model, Manage communication and synchronization, Parallel programming in CUDA- C.

Text Books

1. AnanthGrama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2
2. Seyed H. Roosta, “Parallel Processing and Parallel Algorithms Theory and Computation‖”, Springer-Verlag2000 ,ISBN 978-1-4612-7048-5 ISBN 978-1-4612-1220-1
3. John Cheng, Max Grossman, and Ty McKercher, “Professional CUDA C Programming”, John Wiley & Sons, Inc., ISBN: 978-1-118-73932-7

Reference Books

1. 1.Kai Hwang, ”Scalable Parallel Computing”, McGraw Hill 1998, ISBN:0070317984
2. Shane Cook, “CUDA Programming: A Developer's Guide to Parallel Computing with GPUs”, Morgan Kaufmann Publishers Inc. San Francisco, CA, USA 2013 ISBN: 9780124159884
3. David Culler Jaswinder Pal Singh,” Parallel Computer Architecture: A Hardware/Software Approach”, Morgan Kaufmann,1999, ISBN 978-1-55860-343-1
4. Rod Stephens, “Essential Algorithms”, Wiley, ISBN: 978-1-118-61210-1

Strength of CO-PO / PSO Mapping														
	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	2	-
CO2	3	3	2	2	-	-	-	-	-	-	-	2	2	-
CO3	3	-	-	-	-	-	-	-	-	-	-	2	2	-
CO4	3	3	-	-	2	-	-	-	-	-	-	2	2	-
CO5	3	3	-	-	3	-	-	-	-	-	-	2	2	-
Average	3	3	2	2	2.5	-	-	-	-	-	-	2	2	-

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 each of 15 marks (Total marks will be converted to 15 Marks)	15
2	Theory assignment on Unit-3 and Unit 5each of 10 marks (Total 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)

T. Y. B. Tech. (Computer Engineering)
Pattern 2023 Semester: VI
COM223016: Program Elective Course (II and III) Lab

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory: 02hrs/week	01	Term Work: 25 Marks Oral Exam: 25 Marks

Prerequisite Course: -

Companion Courses: - Program Elective Course II, Program Elective Course III

Course Objectives:

- To study the fundamentals in selected elective subject.
- To design and develop a system / application
- To study modern tools, technologies, and techniques.

Course Outcomes

On completion of the course, students will be able to-

Sr.No	CO Statement	Blooms Taxonomy
COM223014A:User Interface and User Experience Design		
1	Explain user-centered design methodologies	2-Understand
2	Use effective user interfaces / user experiences	3-Apply
COM223014B: Generative AI and Prompt Engineering		
1	Summarize ethical considerations and technical challenges related to manipulating images.	2-Understand
2	Make use of the techniques and Application for Prompt Engineering	3-Apply
COM223014C: High Performance Databases		
1	Apply indexing techniques to improve query performance	3-Apply
2	Make use of transaction management technique to optimize the performance of database	3-Apply
COM223015A: Cloud Computing		
1	Use tools and techniques in the area of Cloud Computing	3-Apply
2	Use cloud computing services for problem solving	3-Apply
COM223015B: Natural Language Processing		
1	Apply text pre-processing techniques on given text.	2-Understand
2	Apply syntactic analysis on given text	3-Apply
COM223015C: High Performance Computing		
1	Analyze performance of sequential and parallel algorithms.	3-Apply
2	Design and implement solutions for multicore/Distributed/parallel environments.	3-Apply

Guidelines for Instructor's Manual
The instructor’ s manual is to be developed as a reference and hands-on resource. It should include prologue (about university/program/ institute/ department/foreword/ preface), curriculum of the course, conduction and Assessment guidelines, topics under consideration, concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.
Guidelines for Student's Laboratory Journal
The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set (if applicable), mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and Program listing to journal must be avoided. Use of DVD containing student’s programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory.
Guidelines for Laboratory /Term Work Assessment
Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes and punctuality.
Guidelines for Oral Examination
Problem statements must be decided jointly by the internal examiner and external examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student ‘s understanding of the fundamentals, effective and efficient implementation. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of student's academics.
Guidelines for Laboratory Conduction
The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignments are based on chosen Program Elective Course II and Program Elective Course III. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open-source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Suggested List of Laboratory Experiments/Assignment		
Sr. No.	**All assignments are compulsory**	**COs**
	COM223014A: User Interface and User Experience Design	
1	Study of various UI/UX design tools: Wireframe, Mockup, Figma Tools Identify specialized users and related facilities for a selected product /system and make necessary suggestions for its improved accessibility design	CO1, CO2
2	Design user persona for the users of selected product / system. How To Create A User Persona (Video Guide) - YouTube How to Create A User Persona in 2022 [FULL GUIDE] - YouTube	CO1, CO2
3	**Create Low-Fidelity and High-Fidelity Wireframes:** Start by sketching low-fidelity wireframes for each page using pen and paper or any digital tool you prefer. Focus on the layout, placement of key elements, and overall structure. Use basic shapes and placeholders to represent different elements such as navigation menus, search bars, images, buttons, and form fields. Aim for simplicity and clarity in your wireframes. **Refine High-Fidelity Wireframes:** Transfer your low-fidelity wireframes to a digital wireframing tool such as Adobe XD, Sketch, Figma, or any other tool you are comfortable with. Create high-fidelity wireframes that incorporate more details, accurate text, and realistic representations of UI components. Pay attention to typography, color schemes, and spacing to improve visual hierarchy and user experience.	CO1, CO2
4	Wireframes & Mockups: task is to create at least one wireframe, and one mockup of a web application. Your wireframe(s) and mockup will need to be responsive and take into account a desktop view and a mobile view.	CO1, CO2
	COM223014B: Generative AI and Prompt Engineering	
1	Generate an image/ text with the fashion MNIST database using an auto-encoder	CO1
2	Building and training a very simple LLM from scratch.	CO1
3	Generate an AI- Image using DALL·E 2 API using Python.	CO2
4	Use Open AI API to craft a perfect AI Image Prompt	CO2
	COM223014C: High Performance Databases	
1	Write a C++ Program to implement B- Tree index	CO1
2	Write MYSQL queries for database securities	CO1
3	Optimize poorly performing SQL queries using optimization techniques such as query rewriting, index selection, query plan analysis and measure performance.	CO2
4	Simulate transaction management by implementing any 2 concurrency control protocols	CO2
	COM223015A: Cloud Computing	
1	Installation and Configuration of virtualization using KVM	CO1
2	Installation and configure Google App Engine.	CO1, CO5
3	Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.	CO1, CO3
4	Creating an Application in SalesForce.com using Apex programming Language.	CO2, CO3
	COM223015B: Natural Language Processing	
1	Perform tokenization (Whitespace, Punctuation-based, Treebank, Tweet, MWE) using NLTK library. Use porter stemmer and snowball stemmer for stemming.	CO1

	Use any technique for lemmatization.	
2	Perform bag-of-words approach (count occurrence, normalized count occurrence), TF-IDF on data. Create embeddings using Word2Vec.	CO2
3	Perform text cleaning, perform lemmatization (any method), remove stop words (any method),label encoding. Create representations using TF-IDF. Save outputs.	CO2
4	POS Taggers For Indian Languages	CO2
	COM223015C: High Performance Computing	
1	Design and implement parallel algorithm to 1. Add two large vectors 2. Multiply a Vector and a Matrix 3. Multiply two Matrices	CO1, CO2
2	Design and implement Parallel Breadth First Search and Depth First Search based on existing algorithms using OpenMP. Use a Tree or an undirected graph for BFS and DFS.	CO1, CO2
3	Design and implement sequential and parallel algorithms for Bubble Sort and Merge sort using OpenMP. Compare the performance of sequential and parallel algorithms.	CO1, CO2
4	Use Parallel Reduction method to implement Min, Max, Sum and Average operations.	CO2

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

T. Y. B. Tech. Computer Engineering
Pattern 2022 Semester: VI
COM223017: Microcontroller and Embedded 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: - COM222004: Digital Electronics and Logic Design
COM222014: Computer Architecture

Course Objectives:

- To get familiar with 8051 microcontroller
- To understand instruction set and assembly language programing of 8051
- To use C programming to write 8051 programs
- To study features of 8051 microcontroller
- To get introduced to embedded systems

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

	Course Outcomes	**Bloom's Level**
CO1	Explain basics of 8051 microcontroller	2-Understand
CO2	Make use of instruction set to write simple assembly language programs of 8051	3-Apply
CO3	Make use of C to write simple 8051 Programs	3-Apply
CO4	Explain features of 8051 microcontroller	2-Understand
CO5	Illustrate basics of embedded systems	2-Understand

COURSE CONTENTS

Unit I	**Introduction to Microcontroller**	**(06 hrs)**	**CO1**

Difference between microprocessor and microcontroller, Introduction to the Microcontroller, Features and block diagram of 8051 and explanation, Program Status Word (PSW), Programmers model-register set, register bank, SFRs

Unit II	**8051 Assembly Language Programming and I/O Port Programming**	**(08 hrs)**	**CO2**

Addressing modes, Introduction to 8051 assembly programming, Structure of assembly language, instruction set: Jump, Loop , Call, arithmetic , logic instructions, 8051 I/O Port Programming

Unit III	**8051 Programming in C**	**(08 hrs)**	**CO3**

Why program the 8051 in C? , Data types and time delay in 8051 C, I/O Programming in 8051 C, Logic Micro operation in 8051 C, Data Conversion programs in 8051 C

Unit IV	**8051 memory, interrupts and timers/counters**	**(08 hrs)**	**CO4**

Memory organization on-chip data memory, External data memory and program memory, Memory interfacing-external RAM/ROM interface. CPU timings, Interrupt structure, 8051 Timers/counters, operation modes of 8051 and their programming

Unit V	**Embedded System**	**(06 hrs)**	**CO5**

Introduction to Embedded systems, Characteristics, Challenges, Processors in Embedded systems, Application Domain, Real time systems, Real time task, Hardware Units and devices in an embedded system

Text Books

1. Muhammad Ali Mazidi and Janice Gillispie Mazidi, Rolin McKinlay, The 8051 Microcontroller and embedded systems , 2009, Pearson education.
2. V Udayashyankara, M S Mallikarjunaswamy, 8051 Microcontroller, , The McGraw Hill Companies
3. Lyla B. Das, Embedded Systems: An Integrated Approach Pearson , ISBN: 9332511675, 9789332511675
4. Raj Kamal, Embedded Systems: Architecture, programming and Design, 2nd Edition, McGraw-Hill, ISBN: 13: 9780070151253

Reference Books

K. J. Ayala, D. V. Gadre , The 8051 Microcontroller and Embedded systems using Assembly and C., Cengage learning, ISBN 9788131511053

Strength of CO-PO/PSO Mapping														
	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	-	-	-	-	-	-	-	-	-	-	-	-	-

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 each of 15 marks (Total marks will be converted to 15 Marks)	15
2	Theory assignment on Unit 4, Unit 5 each of 10 marks (Total marks will be converted to 5 Marks)	5
	Total	**20**

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T.Y. B. Tech Computer Engineering
Pattern 2022 Semester: VI
COM223018: Intellectual Property Rights

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory: 02 hrs / week	**02**	**Continuous Comprehensive Evaluation: 50 Marks**

Prerequisite Courses, if any: -

Course Objectives: Students will be able

1. To define and explain the concept of Intellectual Property Rights (IPR)
2. To develop an understanding of copyright law
3. To gain knowledge of patent law principles, including the criteria for patentability the process of obtaining a patent, and the rights and obligations conferred by patent protection.
4. To understand fundamentals of trademark law
5. To learn about geographical indications (GIs) and their significance in protecting the reputation and quality of goods associated with specific geographical locations

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

	Course Outcomes	**Bloom's Level**
CO1	Define the concepts of Intellectual Property Rights.	1-Remember
CO3	Outline steps of Copyrights registrations.	2-Understand
CO3	Illustrate the process of filing the Patents.	2-Understand
CO4	Explain the fundamentals of Trademarks.	2-Understand
CO5	Illustrate the procedure of filing application of Geographical Indications of Goods.	2-Understand

COURSE CONTENTS

Unit I	**Introduction to Intellectual Property Law**	**(02hrs)**	**COs Mapped – CO1**

The Evolutionary Past - The IPR Tool Kit- Para -Legal Tasks in Intellectual Property Law – Ethical obligations in Para Legal Tasks in Intellectual Property Law. Introduction to Cyber Law – Innovations and Inventions Trade related Intellectual Property Right

Unit II	**Introduction to Copyrights in India**	**(02hrs)**	**COs Mapped – CO2**

Principles of Copyright Principles -The Subjects Matter of Copy right – The Rights Afforded by Copyright Law – Copy right Ownership, Transfer, and duration – Right to prepare Derivative works – Rights of Distribution – Rights of Perform the work Publicity Copyright Formalities and Registrations - Limitations - Copyright disputes and International Copyright Law – Semiconductor Chip Protection Act

Unit III	**Introduction to Patents in India**	**(04hrs)**	**COs Mapped – CO3**

Introduction to the Indian Patent System Patent Laws as Concepts; Understanding the Patents Act, 1970; Understanding the Patents Rules, 2003;Preliminary Sections; Preliminary Rules; Patentability of Inventions Statutory Exceptions to Patentability; Novelty and Anticipation; Inventive Step; Capable of Industrial Application; Patent Specification Provisional and Complete Specifications; Structure of a Patent Specification—Title, Abstract, Description, Claims, etc.; Reading a Patent Specification—Fair

basis, Enabling Disclosure, Definiteness, Priority; Introduction to Patent Drafting.			
Unit IV	**Introduction to Trade Secret and Trademark**	**(02hrs)**	**COs Mapped – CO4**
Maintaining Trade Secret – Physical Security – Employee Limitation - Employee confidentiality agreement - Trade Secret Law - Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law. Trademark Registration Process – Post registration Procedures – Trade mark maintenance - Transfer of Rights - Inter parties Proceeding – Infringement - Dilution Ownership of Trade mark – Likelihood of confusion - Trademarks claims – Trademarks Litigations – International Trademark Laws.			
Unit V	**Introduction to Geographical Indications of Goods**	**(02hrs)**	**COs Mapped – CO5**
Definition of Geographical Indications of Goods, Classification of Goods, Articles 22 to 24 of the Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement, Procedure for Filing G.I Application			

Text Books

1. Debirag E. Bouchoux: "Intellectual Property". Cengage learning, New Delhi
2. Feroz Ali, The Law of Patents, LexisNexis
3. A HAND BOOK OF COPYRIGHT LAW, (https://www.copyright.gov.in/documents/handbook.html)
4. Prof. Rupinder Tewari, Ms. Mamta Bhardwaj, Intellectual Property- A Primer for Academia.
5. Prof. (Dr.) Raju K. D., A Handbook on Geographical Indications in India ,2021

Reference Books

1. Cyber Law. Texts & Cases, South-Western's Special Topics Collections
2. M. Ashok Kumar and Mohd. Iqbal Ali: "Intellectual Property Right" Serials Pub.
3. Ronald D. Slusky, Invention Analysis and Claiming – A Patent Lawyer's Guide, Second Edition, American Bar Association, 2012

MOOC Courses

1. NPTEL Course on Introduction on Intellectual Property to Engineers and Technologists, https://nptel.ac.in/courses/109105112
2. NPTEL course on 'Patent Law for Engineers and Scientists' https://onlinecourses.nptel.ac.in/noc20_hs55/preview

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Quiz on Unit-1, Unit 2 and Unit -3 each of 10 marks. (Total marks will be converted to 30 marks)	30
2	Assignment on Unit-4 and Unit-5 each of 10 marks. (Total marks will be converted to 20 marks)	20
	Total	**50**

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T.Y. B. Tech. Computer Engineering Pattern 2022 Semester: VI COM223019: Mobile Application Development		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Tutorial: 01 hrs/week Practical: 02 hrs/week	**02**	**Term Work: 25 Marks Oral: 25 Marks**
Prerequisite Courses:- CSD222005:Programming Paradigms and Java Programming		
Companion Course: -		

Course Objectives:

- To understand the different mobile application Architectures.
- To facilitate students to understand android SDK
- To help students to gain a basic understanding of Android application development

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

	Course Outcomes	Bloom's Level
CO1	Understand Mobile Application Architectures	2-Understand
CO2	Apply different types of widgets and Layouts	3-Apply
CO3	Make use of the ways of application handling like intents, adapters, Notifications	3-Apply
CO4	Implement data storing and retrieval methods in android	3-Apply
CO5	Explain Security and Implement Application Deployment	3-Apply

COURSE CONTENTS

Unit I	**Introduction to Mobile Application Development**	**(03hrs)**	**CO1**

Mobile application development architectures: Introduction to Mobile Application technologies**,** Android Architecture, IOS Architecture, Windows Architecture, Hybrid Architecture.
Introduction to Android: Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Android Manifest file.

Unit II	**Creating Android Application**	**(03hrs)**	**CO2**

Creating Android project, Project Structure, Activity and Activity Life Cycle, Fragment and Fragment Life Cycle, Views and View groups

Unit III	**Interactivity Tools**	**(02hrs)**	**CO3**

Interactivity Tools: Intents and Filters, Adapters, Dialogs, Menus, Notifications

Unit IV	**Interaction with Database**	**(02hrs)**	**CO4**

Introduction to Database (SQLite), Cursors and content values, CURD Operations			
Unit V	**Security and Application Deployment**	**(02hrs)**	**CO5**
Location Based Services, Getting the Maps API key, Displaying the map, Displaying the zoom control, Navigating to a specific location, Getting Location data, Monitoring location, Android Security Model			

Text Books

1. Lauren Darcey and Shane Conder**,** "Android Wireless Application Development", PearsonEducation, 2nd ed. (2011)

Reference Books

1. Professional Android 4 Application Development by Meier, Reto - Wiley Education
2. Beginning Android 4 Application Development by Lee, Wei- Meng - Wiley Education
3. Android application Development: in 24 hours by Delessio, Carmen; Darcey, Lauren; Conder, Shane - Pearson Education
4. Android by Dixit, Prasanna Kumar - Vikas Publishing House Android Studio Development Essentials Book by Neil Smith

MOOC / NPTEL Courses:
https://onlinecourses.swayam2.ac.in/nou21_ge41/preview

Sr. No.	List of Laboratory Assignments/ Experiments	COs Mapped
1	Installation of Android studio.	**CO1**
2	Create an application that can print a message "Welcome to Android ".	**CO1**
3	Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button.	**CO3**
4	Create a screen that has input boxes for user name, password, address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button (use any layout).	**CO3**
5	Design an android application to create page using Intent and one Button and pass the Values from one Activity to second Activity.	**CO3**
6	Design an Android application Send SMS using Intent.	**CO3**
7	Create an Android application using Fragments.	**CO2**
8	Design an Android application Using Radio buttons.	**CO3**
9	Design an Android application for menu.	**CO3**
10	Create a user registration application that stores the user details in a database table.	**CO4**
11	Develop a Mobile application for simple needs (Mini Project).	**CO2,CO3,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: Eclipse, Android Studio.
Guidelines for Student's Lab Journal
The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, problem statement, theory concepts in brief, algorithm, flowchart, test cases and conclusions). Program codes with sample outputs shall be submitted in soft form.
Guidelines for Term work Assessment
Continuous assessment of laboratory work shall be based on overall performance of a student. Assessment of each laboratory assignment shall be based on rubrics that include R1- timely completion (10), R2- understanding of assignment (10) and R3- presentation/clarity of journal writing (10).

Strength of CO-PO / PSO Mapping														
	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	-	2	-	-	-	-	-	-	-	-	-	2	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO4	2	-	2	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	2	-	-	-	-	-	-	-	-	2	2	2
Average	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

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T. Y. B. Tech. Computer Engineering
Pattern 2022 Semester: VI
COM223020: Seminar

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 2hrs/week	**01**	**Termwork: 50 Marks**

Prerequisite Courses: - FYE221014 Communication Skills

Course Objectives:

- To explore the latest technologies
- To explore the basic principles of communication (verbal and non-verbal) and active, empathetic listening, speaking and writing techniques
- To develop problem analysis skills

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

	Course Outcomes	**Bloom's Level**
CO1	Identify a latest topic of professional interest	3-Apply
CO2	Develop technical writing skills	3-Apply
CO3	Identify an engineering problem, analyze it and propose a work plan to solve it	3-Apply
CO4	Build professional technical presentation skills	3-Apply

Guidelines

- Each student will select a topic in the area of Computer Engineering and Technology preferably keeping track with recent technological trends and development beyond scope of syllabus avoiding repetition in consecutive years.
- The topic must be selected in consultation with the Institute guide.
- Each student will complete literature review for approved topic.
- Each student will make a seminar presentation using audio/visual aids for a duration of 20-25 minutes and submit the seminar report prepared in Latex only.
- Active participation at classmate seminars is essential.
- Seminar Logbook is recommended to use.
- To enhance technical writing skills guide can ask student to write a review paper and publish in reputed journal/conference.

Recommended Format of the Seminar Report

- Title Page with Title of the topic, Name of the candidate with Exam Seat Number / Roll Number, Name of the Guide, Name of the Department, Institution and Year and University
- Seminar Approval Sheet/Certificate
- Abstract and Keywords
- Acknowledgements
- Table of Contents, List of Figures, List of Tables and Nomenclature
- Chapters Covering topic of discussion- Introduction with section including organization of the report, Literature Survey/Details of design/technology/Analytical and/or experimental work, if

any/ .....,Discussions and Conclusions ,Bibliography/References

- Plagiarism Check report
- Report Documentation page

Recommended Format of the Seminar Presentation(PPT)

- Objectives
- Introduction
- Literature Review
- Details of Design/Methodologies/Technologies/Analytical or experimental work
- Algorithms(if any)
- Summary
- References

Guidelines for Termwork Assessment

Panel of staff members along with a guide would be assessing the seminar work based on these Parameters-Topic, Contents and Presentation, regularity, Punctuality and Timely Completion, Question and Answers, Report, Paper presentation/Publication, Attendance and Active Participation. Sample evaluation sheet format given below:

Table 1 : Seminar Evaluation Sheet

Roll. No.	**Name of Student**	**Contents and Quality of Presentation** (Table 2)	**Punctuality and Timely Completion (following of deadline)**	**Seminar Report**	**Question** and **Answers**	**Total**
		25	**05**	**15**	**05**	**50**

Table 2: Contents and Quality of Presentation

Roll No.	**Name of Student**	**Slide Layout**	**Verbal Skill**	**Confidence**	**Contents**	**Total**
		5	**5**	**5**	**10**	**25**

Strength of CO-PO PSO Mapping														
	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	-	2	-	2	-	2	2	3	-	3	-	-
CO2	3	3	-	2	-	2	-	2	2	3	-	3	-	-
CO3	3	3	-	2	-	2	-	2	2	3	-	3	-	-
CO4	3	3	-	2	-	2	-	3	2	3	-	3	-	-
Avg	3	3	-	2	-	2	-	2.25	2	3	-	3	-	-

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

T. Y. B. Tech. Computer Engineering Honors in Computer Network with MDM
Pattern 2022 : Semester: VI
COM223021: Network Protocols and Algorithms

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory: 04 hrs/week	**04**	**Continuous Comprehensive Evaluation: 20 Marks** **InSem Exam: 20 Marks** **EndSem Exam: 60 Marks**

Prerequisite Courses: -

Companion Course :- COM223022 Network Protocols and Algorithms Lab

Course Objectives:

- To introduce the fundamental various types of computer networks.
- To Analyze Data Communication
- To explore the various layers of OSI Model
- Explore Transport Layer Concepts
- Examine Application Layer Protocols

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

	Course Outcomes	**Bloom's Level**
CO1	Summarize fundamental concepts of Computer Networks, architectures, protocols and technologies	2-Understand
CO2	Illustrate the working and functions of data link layer	2-Understand
CO3	Analyze the working of different routing protocols and mechanisms	3-Apply
CO4	Understand Elements of Transport Layer Protocols	2-Understand
CO5	Illustrate role of application layer with its protocols, client-server architectures	2-Understand

COURSE CONTENTS

Unit I	**Introduction to Network Protocols**	**(10 hrs)**	**CO1**

Basic concepts of network protocols and algorithms, OSI model and TCP/IP model Basics of data transmission and networking fundamentals Physical Layer: Guided Transmission media: twisted pairs, coaxial cable, fiber optics, common networking devices such as routers, switches, and hubs Wireless transmission Types of network protocols (e.g., TCP, UDP, IP, HTTP, FTP),Protocol layers and their functions

Unit II	**Data Link Layer**	**(10 hrs)**	**CO2**

Functions of the Data Link Layer in the OSI model , Relationship between the Data Link Layer and physical layer, Framing and Error Detection Error detection methods such as checksums CRC (Cyclic Redundancy Check),Hamming Code ,Techniques for error correction and retransmission, Flow control Protocols - Stop-and-Wait Protocol, The Go-Back-N ,Sliding Window Protocol, Automatic Repeat request (ARQ), Error Control, Address Resolution Protocol (ARP) and Ethernet Data link layer protocols, HDLC, and Point to Point protocol

Unit III	**Network Layer**	**(10hrs)**	**CO3**

Logical Addressing, Internetworking, Tunneling, Address mapping, ICMP, IGMP, Forwarding, Uni-Cast Routing Protocols, Multicast Routing Protocols

Switching Techniques: Circuit switching, Message Switching, Packet Switching.
IP Protocol: Classes of IP (Network addressing), IPv4, IPv6, Network Address Translation, Sub-netting, CIDR. Network layer Protocols: ARP, RARP, ICMP, IGMP. Network Routing and Algorithms: Static Routing, Dynamic Routing, Distance Vector Routing, Link State Routing, Path Vector. Routing Protocols: RIP, OSPF, BGP

Unit IV	**Transport Layer**	**(09hrs)**	**CO4**

The Transport Service: Services Provided to the Upper Layers, Transport Service Primitives, Berkeley Sockets. Elements of Transport Protocols: Addressing, Connection Establishment, Connection Release, Flow Control and Buffering, Multiplexing, Crash Recovery, TCP/IP handshake process Reliable vs. unreliable data transfer. Transport Layer Protocols: TCP and UDP, SCTP, RTP, Congestion control and Quality of Service (QoS), Differentiated services, TCP and UDP for Wireless networks

Unit V	**Application Layer**	**(09hrs)**	**CO5**

Introduction, Web and HTTP, Web Caching, Application Layer Protocols: DNS, Email: SMTP, MIME,POP3, Webmail, FTP, TELNET,DHCP, SNMP, Client-Server Architecture, APIs and Interfaces, Authentication and Authorization, Error Handling and Recovery

Text Books

1. Data Communication and Networking by Behrouz A. Forouzan (Fourth Edition), Tata McGraw Hill
2. Computer Networks by Andrew S. Tanenbaum (Fifth Edition), Pearson Education

Reference Books

1. Kurose, Ross, “Computer Networking a Top Down Approach Featuring the Internet”, Pearson, ISBN-10: 0132856204
2. L. Peterson and B. Davie, “Computer Networks: A Systems Approach”, 5th Edition, Morgan-Kaufmann, 2012.

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	2	-	-	-	-	-	-	-	3	3	2
CO2	3	3	2	2	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	-	-	-	-	-	-	-	3	3	3
Average	3	3	2	2	-	-	-	-	-	-	-	3	3	3

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, (Quiz 15 marks each and will be converted to 15 Marks)	15
2	Theory assignment on Unit-3 and Unit 5	10
	Total	**20**

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

T. Y. B. Tech. Computer Engineering Honors in Computer Network with MDM Pattern 2023 Semester: VI COM223022: Network Protocols and Algorithms Lab		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 04hrs/week	**02**	**Termwork: 50Marks Practical Exam : 50 Marks**
Prerequisite Courses: -		
Companion Course:- COM223021 Network Protocols and Algorithms		

Course Objectives:

- To learn computer network hardware and software components
- To learn computer network topologies and types of network
- To develop an understanding of various protocols, modern technologies and applications
- To learn modern tools for network traffic analysis
- To learn network programming

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

	Course Outcomes	**Bloom's Level**
CO1	Analyze the requirements of network types, topology and transmission media	3-Apply
CO2	Demonstrate error control, flow control techniques and protocols and analyze them	3-Apply
CO3	Demonstrate the subnet formation with IP allocation mechanism and apply various routing algorithms	3-Apply
CO4	Develop Client-Server architectures and prototypes	3-Apply
CO5	Implement web applications and services using application layer protocols	3-Apply

List of Laboratory Experiments / Assignments		
Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	CP/IP Packet Analysis: In this assignment, students capture network traffic using tools like Wireshark and analyze TCP/IP packets to understand the protocols and their interactions.	CO1
2	Routing Algorithm Simulation: Using network simulation tools like NS-3 or Cisco Packet Tracer, students implement and compare various routing algorithms such as Dijkstra's algorithm, OSPF, and BGP.	CO2,CO4
3	Socket Programming: Students write client-server programs using socket programming in languages like Python or Java to implement basic network protocols like HTTP, FTP, or SMTP	CO1
4	Write a program for error detection and correction for 7/8 bits ASCII codes using Hamming Codes or CRC.	CO2
5	Write a program to simulate Go back N and Selective Repeat Modes of Sliding Window Protocol in Peer-to-Peer mode.	CO2
6	Write a program to demonstrate Sub-netting and find subnet masks	CO3

7	Write a program to implement link state /Distance vector routing protocol to find suitable path for transmission	CO3
8	Write a program using TCP socket for wired network for following a. Say Hello to Each other b. File transfer c. Calculator	CO1,CO4
9	Write a program using UDP Sockets to enable file transfer (Script, Text, Audio and Video one file each) between two machines.	CO1,CO4
10	Write a program for DNS lookup. Given an IP address as input, it should return URL and vice-versa.	CO4
Programming Problems		
1	To study the SSL protocol by capturing the packets using Wireshark tool while visiting any SSL secured website (banking, e-commerce etc.).	CO3
2	Illustrate the steps for implementation of S/MIME email security, POP3 through Microsoft Office Outlook.	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++,Cisco Packet Tracer ,Wireshark

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 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
(Autonomous from Academic Year 2022-23)

T. Y. B. Tech. Computer Engineering Honors in Databases with MDM
Pattern 2022 Semester: VI
COM223023: Relational Database and SQL

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory: 04 hrs/week	**04**	**Continuous Comprehensive Evaluation: 20 Marks** **InSem Exam: 20 Marks** **EndSem Exam: 60 Marks**

Prerequisite Courses:-

Companion Courses: - COM223024 :Relational Database and SQL Lab

Course Objectives:

- To understand the fundamentals of database management System and database query languages
- To know the principles of database design and transaction management
- To study database system architecture, storage and indexing

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

	Course Outcomes	**Bloom's Level**
CO1	Illustrate applications of databases, and features of RDBMS	2-Understand
CO2	Construct database queries using SQL, PL/ SQL	3-Apply
CO3	Demonstrate ability to prepare logical design of database using ER model and normalization technique	3-Apply
CO4	Explain various protocols for Transaction Management	3-Understand
CO5	Illustrate database storage and indexing	2-Understand

COURSE CONTENTS

Unit I	**Introduction to databases and Database models**	**(10 hrs)**	**CO1, CO2**

Introduction to Databases: Basic concepts, Advantage of DBMS over file processing system, Data Abstraction, Database Language, Structure of DBMS, Data Modeling, database applications.
Overview of Database Languages and Architectures: Data Models, Schemas and Instances, Data Independence, Database Languages and Interfaces, Database System environment, Centralized and Client-Server Architecture for DBMSs.
Database Design and ER Model: ER Model, Extended E-R Features, converting ER model and EER model to tables, schema diagrams.
Relational Model: The Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Attributes and Domain

Unit II	**SQL and PLSQL**	**(10 hrs)**	**CO2**

Relational Algebra and Calculus: Preliminaries, Relational Algebra, Relational calculus – Tuple relational Calculus, Domain relational calculus
SQL: Introduction to Relational Algebra and Tuple Relational Calculus, Introduction to SQL, SQL Data types and Literals, DDL, DML, DCL, TCL, SQL Select Query and Clauses.
SQL Advanced Features: Set Operation, Aggregate Function, Null Values, Nested Subquery, Views, Joins, Sequence, Index, Introduction to Embedded and Dynamic SQL.
Introduction to PL/SQL: Data types, Procedures, Functions, Cursor, Trigger, Package, Assertions, Roles and Privileges, Oracle Database Architecture

Unit III	**Database Design & Normalization**	**(10 hrs)**	**CO3**

Codd's Rules, Introduction to Schema Refinement, Functional Dependencies - Reasoning about FDs, Properties of Decompositions, Armstrong's Axioms

Normalization: Normal forms based on Primary Keys, Second and Third Normal Forms, BoyceCodd Normal Form, Multi valued Dependencies and Fourth Normal Form, Schema Refinement in Database Design, Other Kinds of Dependencies.

Relational Database Design: Dependency Preservation, Lossless design, Comparison of Oracle & DB2 or MySQL

Unit IV	**Transaction Management**	**(09 hrs)**	

Transaction: Transaction concept, Transaction state, Transaction Property, Concurrent Executions

Serializability: Conflict serializability, View Serializability, Testing for Serializability, Deadlock prevention, Deadlock Detection and Recovery from deadlock.

Concurrency Control Protocols: Two phase Locking, Timestamp-based protocol.

Recovery: Failure classification, Shadow-Paging and Log-Based Recovery

Unit V	**Storage and Indexing**	**(09 hrs)**	**CO5**

Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing, Index Data Structures, Comparison of File Organizations.

Tree-Structured Indexing: Intuition for tree Indexes, Indexed Sequential Access Method (ISAM),

B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.

HashBased Indexing: Static Hashing, Extendible hashing, Linear Hashing, Extendable vs. Linear Hashing.

Backup and recovery strategies: full backups, differential backups, and transaction log backups

Text Books

1. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", 6 th Edition Tata McGraw Hill Publishers, ISBN 0-07-120413-X.
2. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems" , Addison-Wesley, ISBN 978-0133970777

Reference Books

1. C J Date, "An Introduction to Database Systems" ,Addison-Wesly, ISBN:0201144719
2. Thomas Connolly and Carolyn Begg, Database Systems: A Practical Approach to Design, Implementation And Management,Pearson ISBN-13: 9781292061849

Strength of CO-PO PSO Mapping

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	-	-	-	-	-	-	-	-	3	3	2
CO2	3	2	2	-	2	-	-	-	-	-	-	**2**	2	2
CO3	3	2	3	-	2	-	-	-	-	-	-	2	2	-
CO4	2	3	-	-	3	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	-	-
Average	3	2	2.	-	2	-	-	-	-	-	-	2	2.	2.

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

T. Y. B. Tech. Computer Engineering Honors in Databases with MDM **Pattern 2022 Semester: VI** **COM223024 :Relational Database and SQL Lab**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 04 hrs/week	**02**	**Termwork: 50 Marks** **Practical Exam : 50 Marks**
Prerequisite Courses:-		
Companion Courses: - COM223023 :Relational Database and SQL		

Course Objectives:

- To understand the fundamentals of database management System and database query languages
- To know the principles of database design and transaction management
- To study database system architecture and indexing

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

	Course Outcomes	**Bloom's Level**
CO1	Make use of normalized relational database schemas to represent real-world scenarios	3-Apply
CO2	Build simple and complex SQL queries and PL/ SQL code to retrieve, manipulate relational database	3-Apply
CO3	Construct ER diagram to represent logical design of a database	3-Apply
CO4	Apply the concepts of indexing and DBA queries	3-Apply
CO5	Develop database-driven applications using programming languages and frameworks that interact with relational database systems	3-Apply

List of Laboratory Experiments / Assignments		
Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	**SQL Queries** Assume that a Consumer item lease Company which leases various household items to its clients for their use for a specific period of time, maintains the following tables: Clients (clientID, name, address, contact Phone) Itemlist (itemID, itemName, itemCost, purchase Date) Leaselist (clientID, transactionNO, itemID, startDate, FindDate, amountTObeCharged) Note: A client may lease an item many times. Amount to be charged is calculated as per a fixed rate multiplied by the number of days the item is leased. All items have a unique itemID. However, two or more items may have the same name. Create the tables having appropriate referential integrity constraints. Make and state assumptions, if any. Write and run the following SQL queries on the tables: a. Find all the client names that have not got any item leased during the last	CO1, CO2

	month and no leased item is pending with them. b. Find the list of all the items that were leased or Finded last month. c. Find the names of all those clients who have given the business to the company in the decreasing order of total amount paid by a client. d. List the client's details and the items leased to them at present. e. Find the client who has been leased at least two items.	
2	**Index, Sequence and View** Consider the given relational table: employee(empno , empname, designation, city, salary, zipcode, county) Write SQL queries for the following 1. Create a sequence used to generate employee numbers for the empno column of the emp table. 2. Create an Index on county. 3. Find the country whose zipcode = 071 and check whether the query uses the Index and write your observation. 4. Create a view for employees having salary < 50000 and stays in 'Mumbai' 5. Display a Count of employees who stays in 'Mumbai' 6. Find average salary of employees of a created view 7. Display employee names who stays on same street of a view	CO1, CO2
3	**SQL Joins** Consider the given database schema: Professor (ssn , profname, status, salary) Course(crscode ,crsname,credits) Taught(crscode,semester,ssn) Assumptions: a. Each course has only one instructor in each semester. b. All professors have different salaries. c. All professors have different names. d. All courses have different names. e. Status can take value from "full","associate" , and "assistant". i) Find those professors who have taught "csc6710" but never "csc7710" ii) Find those professors who have taught "csc6710" and "csc7710" in the same semester. iii) Find those professors who have taught "csc6710 " or "csc7710" but not both. iv) Find the course which has never been taught. v) Find courses that have been taught at least in two semesters. vi) Find the names of all professors who have ever taught "csc7710". vii) Change all credits to 4 for those courses that are taught in semester "f2006:. viii) Find the professor who earns the second highest salary. ix) Delete those professors who have never taught.	CO1, CO2
4	**ER Modelling and Normalization:** Conceptual Design using ER features using tools like ERD plus, ER Win etc. (Identifying entities, relationships between entities, attributes, keys, cardinalities, generalization, specialization etc.) Convert the ER diagram into relational tables and normalize the Relational data model.	CO3
5	**Normalization** Wholesale Dealer Consider the following relation that keeps track of the sales of a wholesale dealer in trousers: TrousersSold(customerID, customerName, model, size, day,	CO1

	numberSold, price) Suppose the following functional dependencies hold on the relation: customerID -> customerName customerID, model, size, day -> numberSold model, size -> price model, price -> size a. Decompose the relation in smaller relations such that – each of the smaller relations is in BNCF with respect to the projection of the original dependencies; – the decomposition is a loss less join decomposition. b. Is your decomposition dependency preserving? If your answer is "yes", argue why. If your answer is "no", show which dependencies have been lost.	
6	**PL/SQL block** Create a database with following schemas Employee(Id, Name, mobile, address, salary) & Sales(Id, Month, Amount) Write a PL/SQL block to accept employee id and calculate the bonus according to sale amount if sale amount < 50000 then no bonus if sale amount between 50000 to 150000 then bonus is 5% If sale amount >150000 bonus is 10% Display the final salary of the employee (salary + bonus)	CO1, CO2
7	**Cursors** Write a block in PL/SQL to modify the accounts table according to instructions stored in the action table. Each row in the action table contains an account number, an action to be taken (I, U, or D for insert, update, or delete), an amount by which to update the account, and a time tag used to sequence the transactions. Use explicit cursor	CO1, CO2
8	**Database Trigger** Create a Library database with the schema Books(AccNo, Title, Author, Publisher, Count). a. Create a table Library_Audit with same fields as of Books and Date and status column b. Create a before trigger to insert records into Librry_Audit table if there is deletion in Books table, insert date of deletion and status as deleted Create a after trigger to insert records into Librry_Audit table if there is updation in Books table , insert date of updation and status as updated	CO1, CO2
9	**Database Connectivity**: Write a program to implement Menu driven MySQL/Oracle database connectivity with any front end language for Python/Java/PHP to implement Database navigation operations (add, delete, edit etc.)	CO1,CO4
10	**Write queries for Database Administrative work** a. Develop an SQL script to delete all inactive user accounts that have not been logged in for more than six months from a user database b. User Management: i. Create a new user account with appropriate privileges and Modify the privileges of an existing user account to grant or revoke specific permissions.	CO4

	c. Security: i. Enforce password policies to ensure strong and secure passwords for user accounts ii. Implement encryption for sensitive data stored in the database. d. Backup and Recovery: i. Perform a full database backup using appropriate backup tools or commands. ii. Schedule automated backups to run at regular intervals	
11	Write a program in C++ to implement B+ tree	CO4
12	**Mini Project:** Form a group of 3 or 4 students and Using the database concepts covered, develop an application with following details: 1. Define a problem statement 2. Follow the Software Development Life cycle and other concepts learnt in Software Engineering Course throughout the implementation. 3. Develop application considering: Front End: Java/Perl/PHP/Python/Ruby/.net/any other language Backend : MySQL/Oracle 4. Test and validate applications using Manual/Automation testing.	CO1 to 5
Additional Lab Assignments		
1	**ER Modeling** Conceptual Design using ER features using tools like ERD plus, ER Win etc. (Identifying entities, relationships between entities, attributes, keys, cardinalities, generalization, specialization etc.) Convert the ER diagram into relational tables and normalize the Relational data model. ER model of a Hospital management using the following description . Each of these entities have their respective attributes which are − Patients - ID(primary key), name, age,visit_date Tests- Name(primary key), date, result Doctor- ID(primary key), name, specialization	CO3
2	**SQL Queries** SQL queries involving the supplier, product, and part tables: 1. Retrieve the names of all suppliers from the suppliers table. 2. Retrieve the names of all products along with their corresponding suppliers from the products and suppliers tables. 3. Retrieve the list of parts supplied by each supplier, including supplier names and the names of parts supplied, from the suppliers, products, and parts tables. 4. Retrieve the details of products supplied by a specific supplier, including product names, descriptions, and prices, from the products, suppliers, and parts tables. 5. Retrieve the details of parts used in a specific product, including part names, descriptions, and quantities used, from the products, parts, and product_parts tables. 6. Retrieve the total number of products supplied by each supplier from the products and suppliers tables.	CO1, CO2

	7. Retrieve the names of suppliers who provide high-quality parts, where quality is defined as parts with a rating above a certain threshold, from the suppliers, parts, and product_parts tables. 8. Retrieve the names of parts that are not supplied by any supplier from the parts and product_parts tables. 9. Retrieve the names of products that do not require any parts from the products and product_parts tables. 10. Retrieve the names of suppliers who provide a diverse range of products, where diversity is defined as supplying products from multiple categories, from the suppliers, products, and categories tables.	
3	**PLSQL Block** Write a Stored Procedure namely proc_Grade for the categorization of students. If marks scored by students in examination is <=1500 and marks>=990 then students will be placed in distinction category if marks scored are between 989 and 900 category is first class, if marks 899 n 825 category is Higher Second Class and Less than 825 and > 600 have 'Pass Class'. Insert the result in Result table for all Write a Stored Procedure for calculating Number of students getting each class e.g Distinction - 10 students, First class -5 students. Insert count in the Analysis table Write a PL/SQLblock to use procedures created with the above requirement. Stud_Marks(roll, name, total_marks) Result(Roll,Name, Class) Analysis(class , count)	CO1, CO2

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 like MySQL

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

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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)

Strength of CO-PO PSO Mapping

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CO1	3	2	2	-	-	-	-	-	-	-	-	3	3	2
CO2	2	2	2	-	2	-	-	-	-	-	-	**2**	2	2
CO3	3	2	3	-	2	-	-	-	-	-	-	2	2	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	3	-	-	3	-	-	-	-	-	-	-	-	-
Average	2.40	2.20	2.25	-	2.25	-	-	-	2	-	-	2.33	2.33	2.00