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

Curriculum

B.Tech.

Artificial Intelligence and Data Science

2023 Pattern

K.K.Wagh Institute of Engineering Education and Research, Nashik (Autonomous w.e.f. A.Y.2022-23)
Details of Course Structure: TY B.Tech (2023 Pattern) Semester: V

Board of Studies in Artificial Intelligence and Data Science

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
2301301	PCC	Data Structures and algorithms	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2311302	PCC	Artificial Intelligence	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2311303	PCC	Data Science and Big Data	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2311304	PCC	Artificial Intelligence and Data Science Lab	-	-	2	-	-	-	-	25	25	-	50	-	-	1	1
2301305	PCC	Data Structures and algorithms Lab	-	-	2	-	-	-	-	25	25	-	50	-	-	1	1
	PEC	Program Elective Course I	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
	PEC	Program Elective Course I Lab	-	-	2	-	-	-	-	25	-	25	50	-	-	1	1
2301308	OE	Management Information System	2	-	-	-	-	50	-	-	-	-	50	2	-	-	2
2301309	MDM	Computer Organization and Architecture	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2311310	CEP	Project Based Learning	-	1	2	-	-	-	25	25	-	-	50	-	1	1	2
		Total	**17**	**1**	**8**	**100**	**300**	**150**	**25**	**100**	**50**	**25**	**750**	**17**	**1**	**4**	**22**

Elective I		**Elective I Lab**	
Course Code	**Title of Course**	**Course Code**	**Title of Course**
2301306A	Internet of Things	2301307A	Internet of Things Lab
2301306B	Augmented Reality and Virtual Reality	2301307B	Augmented Reality and Virtual Reality Lab
2301306C	Software Testing and Quality Assurance	2301307C	Software Testing and Quality Assurance Lab

Name and Sign of BoS Chairman **Sign of Director**

K.K.Wagh Institute of Engineering Education and Research, Nashik (Autonomous w.e.f. A.Y.2022-23)
Details of Course Structure: TY B.Tech (2023 Pattern) Semester: VI

Board of Studies in Artificial Intelligence and Data Science

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
2311311	PCC	Business Intelligence and Analytics	3	-	-	20	60	20	-	-		-	100	3	-	-	3
2301312	PCC	Theory of Computation	3	-	-	20	60	20	-	-		-	100	3	-	-	3
2311313	PCC	Data Science Techniques and Tools Lab	-	-	2	-	-	-	-	25	25	-	50	-	-	1	1
	PEC	Program Elective CourseII	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
	PEC	Program Elective CourseIII	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2311316	PEC	Programming Lab	-	-	2	-	-	-	-	25	-	25	50	-	-	1	1
2301317	MDM	Microcontrollers and Embedded Systems	3	-	-	20	60	20	-	-	-	-	100	3	-	-	3
2301318	OE	Project Planning and Management	2	-	-	-	-	50	-	-	-	-	50	2	-	-	2
2311319	VSEC	Mobile Application Development	-	1	2	-	-	-	25	-	-	25	50	-	1	1	2
2311320	RM	Research Seminar	-	-	2	-	-	-	-	50	-	-	50	-	-	1	1
		Total	**17**	**1**	**8**	**100**	**300**	**150**	**25**	**100**	**25**	**50**	**750**	**17**	**1**	**4**	**22**

Elective II		Elective III	
Course Code	Title of Course	Course Code	Title of Course
2301314A	User Interface and User Experience	2301315A	Cloud computing
2311314B	Neural Network and Fuzzy Logic	2301315B	Natural Language Processing
2311314C	Web Technology	2311315C	Cyber Security

Name and Sign of BoS Chairman **Sign of Director**

T. Y. B. Tech. Artificial Intelligence and Data Science
Pattern 2023 Semester: V
2301301: Data Structures and 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: - 2311203: Data structures, 2301201: Discrete Structures

Course Objectives:

- To understand basic concepts of nonlinear data structures such as trees, graphs
- To learn advanced data structures such as indexing techniques and multiway search trees
- To analyze performance of different algorithmic strategies in terms of time and space

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

	Course Outcomes	Bloom's Level
CO1	Describe the asymptotic notations in algorithm analysis	2 - Understand
CO2	Make use of trees and graph data structures to effectively solve a given problem	3-Apply
CO3	Use different representations of symbol table , efficient indexing techniques and multiway search trees to store and maintain data	3-Apply
CO4	Apply Greedy and Dynamic Programming strategies to solve optimization and scheduling problems.	3-Apply
CO5	Apply Backtracking and Branch-and-Bound techniques to solve constraint satisfaction and combinatorial optimization problems.	3-Apply

COURSE CONTENTS

Unit I	Algorithm Analysis and Graph Algorithms	(07 hrs)	CO1, CO2

Analysis: Input size, best case, worst case, average case Counting Dominant operators, Growth rate, upper bounds, asymptotic growth, O, Ω, Θ, o and ω notations, polynomial and non-polynomial problems. Introduction to deterministic and non-deterministic algorithms, P- class problems, NP-class of problems, Polynomial problem reduction NP complete problems

Graphs- Basic Concepts, Storage representation- Adjacency matrix, Adjacency list, Adjacency multi list Traversals-Depth First Search (DFS) and Breadth First Search (BFS) Spanning Tree - Connected components, Minimum spanning Tree, Greedy algorithms- Prim's and Kruskal's for MST

Unit II	Trees	(07 hrs)	CO2

Trees- Basic terminology, General tree and its representation, Representation using sequential and linked organization, converting tree to binary tree, Types of trees Binary tree- Properties, ADT, Representation using sequential and linked organization, Binary tree traversals (recursive and non-recursive)- inorder, preorder, postorder, Operations on binary tree, Applications of Binary trees

Binary Search Tree (BST) - Concept, Definition, Comparison with binary tree, BST operations, applications of BST

Threaded binary tree, Expression tree

Unit III	Symbol table, indexing and multiway tree	(08 hrs)	CO3

Symbol Tables: Static and dynamic tree tables, AVL trees, AVL Tree implementation, Algorithms and analysis of AVL Tree

Multiway search trees, B-Tree- Insertion, Deletion, B+ Tree - Insertion, Deletion, Use of B+ tree in Indexing

Heaps- Concept, Insert, Delete operation, Heap sort

Unit IV	Greedy And Dynamic Programming algorithmic Strategy	(07 hrs)	CO4

Introduction to Algorithmic Strategies: Greedy, Dynamic Programming, Backtracking, Branch and Bound

Greedy strategy: Principle, control abstraction, time analysis of control abstraction, knapsack problem, scheduling algorithms -Job scheduling and activity selection problem.

Dynamic Programming: Principle, control abstraction, time analysis of control abstraction, binomial coefficients, OBST, 0/1 knapsack, Chain Matrix multiplication.

Unit V	Backtracking and Branch and Bound	(07 hrs)	CO5

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.

Text Books

1. Horowitz, Sahani, Dinesh Mehata, "Fundamentals of Data Structures in C++", Galgotia Publisher, ISBN: 8175152788, 9788175152786
2. Gills Brassard and Paul Bartly, Fundamentals of Algorithmic, PHI New Delhi.
3. The Design and Analysis of Computer Algorithms, Aho,Hopcroft,Ullman

Reference Books

1. Sartaj Sahani, "Data Structures, Algorithms and Applications in C++", Second Edition, University Press, ISBN:9788173715228
2. G A V Pai, "Data Structures and Algorithms", McGraw-Hill Companies, ISBN:978007066726
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms" , ISBN 978-0-262-04630-5

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Unit I - Quiz (10 marks and will be converted to 4 marks)	4
2	Unit II - Quiz (10 marks will be converted to 4 marks)	4
3	Unit III - Quiz (10 marks will be converted to 4 marks)	4
4	Unit IV - Assignment (10 marks and will be converted to 4 marks)	4
5	Unit V - Assignment (10 marks and will be converted to 4 marks)	4
	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: V
2311302: 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: - 2311203: Data Structures

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, Uninformed 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	(08 hrs)	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	(07 hrs)	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 and Planning	(07 hrs)	CO5

Ontological Engineering, Categories and Objects, Events, Mental Events. Automated planning: Classical

Planning, Algorithms for classical planning, Forward State-space search for planning, Backward State-space search for planning.

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

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Unit I - Quiz (10 marks and will be converted to 4 marks)	4
2	Unit II - Quiz (10 marks will be converted to 4 marks)	4
3	Unit III - Quiz (10 marks will be converted to 4 marks)	4
4	Unit IV - Assignment (10 marks and will be converted to 4 marks)	4
5	Unit V - Assignment (10 marks and will be converted to 4 marks)	4
	Total	**20**

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

T. Y. B. Tech. Artificial Intelligence and Data Science
Pattern 2023 Semester: VI
2311303 : 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: - :2311212 Database Management System

Companion Course:-: 2311304 Artificial Intelligence and Data Science 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	Describe the working and characteristics of various regression algorithms	2-Understand
CO3	Explain the features and applications of different classification algorithms	2-Understand
CO4	Compare different clustering algorithms.	2-Understand
CO5	Identify the key stages of the data analytics life cycle and their purpose in solving data-driven problems	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	**Un Supervised 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

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

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Unit I - Quiz (10 marks and will be converted to 4 marks)	4
2	Unit II - Quiz (10 marks will be converted to 4 marks)	4
3	Unit III - Written Test (10 marks will be converted to 4 marks)	4
4	Unit IV - Written Test(10 marks and will be converted to 4 marks)	4
5	Unit V - Presentation (10 marks and will be converted to 4 marks)	4
	Total	**20**

K.K.Wagh Institute of Engineering Education and Research, Nashik
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T. Y. B. Tech Artificial Intelligence and Data Science
Pattern 2023 Semester: V
2311304: Artificial Intelligence and Data Science Lab

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

Prerequisite Courses: - 2311205 Data Structures Lab , 2311215: Database Management System Lab

Companion Courses:- 2311302: Artificial Intelligence, 2311303: Data Science and Big Data

Course Objectives:

- To study different informed search / uninformed search or heuristic approaches
- To use of adversarial search algorithms to solve a given problem
- To select a method to solve constraint satisfaction problem
- To acquaint with the fundamentals of knowledge and reasoning

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

	Course Outcomes	Bloom's Level
CO1	Apply different informed search / uninformed search or heuristic approaches	3-Apply
CO2	Make use of adversarial search algorithms to solve a given problem	3-Apply
CO3	Choose a method to solve constraint satisfaction problem	3-Apply
CO4	Implement a knowledge-based agent using propositional logic.	3-Apply
CO5	Make a use of suitable AI algorithms to solve problems.	3-Apply
CO6	Make use of data pre-processing techniques to simplify and speed up machine learning algorithms	3-Apply
CO7	Analyze the performance of classification algorithms for given datasets	4-Analyze
CO8	Analyze the performance of clustering algorithms for given datasets	4-Analyze
CO9	Analyze the performance of regression algorithms for given datasets	4-Analyze

List of Laboratory Experiments / Assignments

Sr. No.	Laboratory Experiments / Assignments	CO
1	Implement A star (A*) Algorithm for any game search problem.	CO1
2	Implement MiniMax algorithm for Tic-Tac-Toe game.	CO2
3	Implement Alpha-Beta Tree search for any game search problem.	CO2
4	Implement a solution for a Constraint Satisfaction Problem using i)Branch and Bound n-queens problem ii)Backtracking for a graph coloring problem. iii) Backtracking for solving a 9 x 9 Sudoku puzzle.	CO3
5	Develop an elementary chatbot for any suitable customer interaction application	CO4

6	Mini Project: Implement any one of the following Expert System: Hospitals and medical facilities, Employee performance evaluation, Airline scheduling and cargo schedules	CO5
7	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.	CO6
8	Implement PCA Feature extraction technique on any data set	CO6
9	A) Create a **Linear Regression Model** using Python/R to predict home prices using Boston Housing Dataset (https://www.kaggle.com/c/boston-housing). OR B) Implement **logistic regression** using Python/R to perform classification on Social_Network_Ads.csv dataset. Evaluate the model	CO9
10	A) 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. OR B) 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.	CO7
11	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	CO8

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++/python/prolog
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 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)

T. Y. B. Tech. Artificial Intelligence and Data Science **Pattern 2023 Semester: V** **2301305: Data Structures and Algorithms Lab**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 02 hrs/week	**01**	**Termwork: 25 Marks** **Practical:25 Marks**
Prerequisite Courses: - 2311205: Data structures Lab		
Course Objectives: ● To understand basic concepts of nonlinear data structures such as trees, graphs ● To learn advanced data structures such as indexing techniques and multiway search trees ● To analyze performance of different algorithmic strategies in terms of time and space		

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

	Course Outcomes	Bloom's Level
CO1	Make use of non-linear data structures such as graph and trees to solve a given problem	3-Apply
CO2	Use different representations of symbol table, efficient indexing techniques and multiway search trees to store and maintain data	3-Apply
CO3	Apply the Greedy strategy to solve the fractional knapsack problem.	3-Apply
CO4	Apply Dynamic Programming or Branch and Bound strategy to solve the 0-1 knapsack problem.	3-Apply
CO5	Analyze the asymptotic performance of algorithm	4- Analyze

List of Laboratory Experiments / Assignments

Sr. No.	Laboratory Experiments / Assignments	CO Mapped
1	**Flight management**: There are flight paths between cities. If there is a flight between city A and city B, then there is an edge between the cities. The cost of the edge can be the time that flight takes to reach city B from A, or the amount of fuel used for the journey. Write a menu driven C++ program to represent this as a graph using adjacency matrix and adjacency list. The node can be represented by the airport name or name of the city. Check whether cities are connected through flight or not. Compare the storage representation.	CO1, CO5
2	**Binary search tree:** Write a menu driven C++ program to construct a binary search tree by inserting the values in the order give, considering at the beginning with an empty binary search tree, after constructing a binary tree- i. Insert new node, ii. Find number of nodes in longest path from root, iii. Minimum data value found in the tree iv. Search a value v. Print values in ascending and descending order	CO1, CO5
3	**Expression tree**: Write a menu driven C++ program to construct an expression tree from the given prefix expression e.g. +--a*bc /def and perform following operations: 1.Traverse it using Inorder, Preorder and Post order traversal (recursive and non-recursive) 2.Change a tree so that the roles of the left and right pointers are swapped at every node	CO1, CO5
4	**A Dictionary using AVL**: A Dictionary stores key and value pairs Data: Set of (key, value) pairs, Keys are mapped to values, Keys must be comparable, Keys must be unique.	CO2, CO5

	Standard Operations: Insert (key, value), Find(key), Delete(key) Write a menu driven C++ program to provide above standard operations on dictionaries and provide a facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Height balanced tree(AVL) and find the complexity for finding a keyword	
5	Write a program to solve a fractional Knapsack problem using a greedy method.	CO3, CO5
6	Write a program to solve a 0-1 Knapsack problem using dynamic programming or branch and bound strategy. Or Write a program to solve a 0-1 Knapsack problem using dynamic programming or branch and bound strategy.	CO4, CO5
Mini Project		
	Design and implement an application oriented mini project on the concept of Graphs / Trees / Symbol table/ indexing techniques/ multiway tree in a group of students. Use different Algorithmic strategies for it.	CO1 to CO5
Extra programming Problems		
1	**Min/max Heaps**: Marks obtained by students of second year in an online examination of a particular subject are stored by the teacher. Teacher wants to find the minimum and maximum marks of the subject. Write a menu driven C++ program to find out maximum and minimum marks obtained in that subject using heap data structure. Analyze the algorithm	CO1, CO5
2	**A Dictionary using STL map and Hashmap**: Implement Dictionary (key and value pairs) using **STL map in C++** and **Hashmap in Java** and compare all dictionary implementation 1. BST 2. AVL 3. User defined Hash table 4. STL Map 5. Hashmap in Java Use Visual C++ and Java Compiler	CO1, CO2, CO5
3	**Optimal Binary search tree**: Given sequence k = k1 <k2 < ... <kn of n sorted keys, with a search probability pi for each key ki. Write a C++ program to build the Binary search tree that has the least search cost given the access probability for each key.	CO2, CO5
4	**Huffman algorithm**: Write a C++ program to implement a file compression algorithm that uses a binary tree. Your program should allow the user to compress and decompress messages containing alphabets using the standard Huffman algorithm for encoding and decoding.	CO1, CO5

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++/VC++

Guidelines for Student's Lab Journal

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

Guidelines for Termwork Assessment

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

K.K.Wagh Institute of Engineering Education and Research, Nashik
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T. Y. B. Tech. Artificial Intelligence and Data Science
Pattern 2023 Semester: V
2301306A: 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: 2301206:Digital Electronics and Logic Design

Companion Course: 2301307A: Internet of Things Lab

Course Objectives:

- To understand the fundamentals of the 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

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Unit I - Written Test (10 marks and will be converted to 4 marks)	4
2	Unit II - Assignment (10 marks will be converted to 4 marks)	4
3	Unit III - Written Test (10 marks will be converted to 4 marks)	4
4	Unit IV - Quiz (10 marks and will be converted to 4 marks)	4
5	Unit V - Quiz (10 marks and will be converted to 4 marks)	4
	Total	**20**

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

T. Y. B. Tech Artificial Intelligence and Data Science
Pattern 2023 Semester: V
2301306B: Augmented Reality and 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: - 2311203: Data Structures

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.

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Unit I - Quiz (10 marks and will be converted to 4 marks)	4
2	Unit II - Quiz (10 marks will be converted to 4 marks)	4
3	Unit III - Quiz (10 marks will be converted to 4 marks)	4
4	Unit IV - Assignment (10 marks and will be converted to 4 marks)	4
5	Unit V - Assignment (10 marks and will be converted to 4 marks)	4
	Total	**20**

K.K.Wagh Institute of Engineering Education and Research, Nashik
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TY B.Tech Artificial Intelligence and Data Science
Pattern 2023 Semester: V
2301306C: 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: - 2301213:Software Engineering

Companion Course:- 2301307C: Software Testing and Quality Assurance Lab

Course Objectives

- To understand various software testing methodologies and their applications.
- To gain hands-on experience with test planning, case design, and defect tracking.
- To explore concepts of quality assurance in software processes.
- To emphasize testing strategies for modern software applications including web and mobile systems.
- To introduce standards and metrics for software quality.

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

	Course Outcomes	**Bloom's Level**
CO1	Describe software testing fundamentals, principles, and lifecycle	2 – Understand
CO2	Design and apply various software testing techniques	3 – Apply
CO3	Use automated tools and frameworks for functional and regression testing	3 – Apply
CO4	Understand software quality standards, metrics, and process models	2 – Understand
CO5	Evaluate software testing strategies for real-world applications	4 – Analyze

COURSE CONTENTS

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

Principles of software testing, Testing Life Cycle (STLC), Test Plan, Test Case, Bug Life Cycle, Types of testing: Functional, Non-Functional, Regression, Smoke, Sanity

Self-study: V-Model, Agile Testing Concepts

Unit II	**Testing Techniques and Strategies**	**(08 hrs)**	**CO2**

White-box testing: Basis path testing, Control flow testing, Black-box testing: Equivalence class partitioning, Boundary value analysis, Integration, System and Acceptance Testing, Test-Driven Development (TDD)

Unit III	**Automated Testing Tools and Frameworks**	**(08 hrs)**	**CO3**

Introduction to Selenium, JUnit, TestNG, Continuous Integration Tools: Jenkins, Automation frameworks – data-driven, keyword-driven, hybrid, Hands-on with test scripts and reports

Unit IV	**Software Quality Assurance and Metrics**	**(06 hrs)**	**CO4**

Software Quality: Definition, Goals, SQA Activities, Reviews, Audits, Quality Metrics: Defect Density, Mean Time to Failure (MTTF), Code Coverage

Self-study: Six Sigma and ISO Standards

Unit V	Current Trends and Case Studies	(08 hrs)	CO5
Web, Mobile, Cloud Application Testing, Security Testing and Performance Testing, Case Studies on Defect Management, Test Strategy Design, Emerging Trends: AI in Testing, DevTestOps			

Text Books

1. Srinivasan Desikan and Gopalaswamy Ramesh, Software Testing: Principles and Practices, Pearson Education
2. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, CRC Press
3. Rex Black, Foundations of Software Testing ISTQB Certification, Cengage Learning

Reference Books

1. Glenford Myers, Tom Badgett, Corey Sandler, The Art of Software Testing, Wiley
2. Aditya P. Mathur, Foundations of Software Testing, Pearson
3. Ron Patton, Software Testing, SAMS Publishing

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Unit I - Quiz (10 marks and will be converted to 4 marks)	4
2	Unit II - Quiz (10 marks will be converted to 4 marks)	4
3	Unit III - Quiz (10 marks will be converted to 4 marks)	4
4	Unit IV - Assignment (10 marks and will be converted to 4 marks)	4
5	Unit V - Assignment (10 marks and will be converted to 4 marks)	4
	Total	**20**

K.K.Wagh Institute of Engineering Education and Research, Nashik
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T. Y. B. Tech. Artificial Intelligence and Data Science **Pattern 2023 Semester: V** **2301307A: 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: 2301207: Digital Electronics Lab		
Companion Course: 2301306A: 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 publish the temperature information and interested applications can	CO1, CO3

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

K. K. Wagh Institute of Engineering Education and Research, Nashik
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T. Y. B. Tech Artificial Intelligence and Data Science Pattern 2023 Semester: V 2301307B: Augmented Reality and Virtual Reality Lab		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 02 hrs/week	**01**	**Term work: 25 Marks Oral Exam : 25 Marks**
Prerequisite Courses: - 2311205: Data Structures Lab		
Companion Course: 2301306B: Augmented Reality and 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. 1	Study of various AR & VR Development tools such as UNITY 3D IDE and its documentation.	CO1
2. 3	Create a C# script that plays a video when an image is scanned using AR App (AR Core & Unity).	CO3
3. 4	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. 5	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. 6	Demonstration of the working of HTC Vive, Oculus Quest 2, Microsoft Hololens2.	CO2
6. 7	Develop a scene in Unity that includes: I. A cube, plane and sphere, apply transformations on the 3 game objects. II. Add a video and audio source.	CO4
7. 8	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,	CO4

	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.	
8. 9	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. 10	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)

K.K.Wagh Institute of Engineering Education and Research, Nashik
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TY B. Tech Artificial Intelligence and Data Science Pattern 2023 Semester: V 2301307C: 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: - -		

Course Objectives

- To understand various software testing approaches including manual and automation.
- To implement test planning, execution, and defect reporting processes.
- To explore quality assurance strategies and metrics.
- To use automation tools to streamline testing processes.

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

	Course Outcomes	**Bloom's Level**
CO1	Apply manual testing techniques to identify software bugs	3 – Apply
CO2	Design effective test cases based on requirements	3 – Apply
CO3	Automate test cases using testing tools like Selenium	3 – Apply
CO4	Analyze and document test results and quality metrics	4 – Analyze

List of Laboratory Experiments/ Assignments

Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	Perform functional testing for a sample application. Design and execute test cases. Document defects in a bug tracking sheet.	CO1, CO2
2	Design test cases using boundary value analysis and equivalence class partitioning for a module.	CO2
3	Implement and execute test cases using Selenium WebDriver for a login page.	CO3
4	Automate test suite using TestNG and generate test reports.	CO3
5	Evaluate test coverage and code quality using open-source tools (e.g., JaCoCo, SonarQube).	CO4
6	Simulate load testing using JMeter on a web application and analyze performance metrics.	CO4
7	Prepare a software test plan (STP) and test summary report (TSR) for a case study.	CO2, CO4
8	Conduct a defect analysis and prepare defect density and priority-severity matrix.	CO4

Guidelines for Laboratory Conduction
Use coding standards, indentation, and inline comments. Use of open-source testing tools is encouraged. Operating System: Linux or Windows Recommended Tools: Selenium, JUnit/TestNG, JMeter, JaCoCo, SonarQube
Guidelines for Student's Lab Manual
Each lab assignment should be handwritten and include: - Title, problem statement, theory, algorithm, flowchart - Test cases and result observations - Conclusion, source code (printed), and outputs (screenshots/logs) - Journal should also have Certificate and Table of Contents
Guidelines for Term Work Assessment
Assessment for each lab assignment will be based on: ● R1 - Timely completion (10 Marks) ● R2 - Understanding of assignment (10 Marks) ● R3 - Presentation/clarity of journal writing (10 Marks)

K.K.Wagh Institute of Engineering Education and Research, Nashik
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T. Y. B. Tech. Artificial Intelligence and Data Science
Pattern 2023 Semester: V
2301308: Management Information Systems

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

Prerequisite Courses: - 2301218: Customer Relationship Management

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 an 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	(04 hrs)	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	(05 hrs)	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	(05 hrs)	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	(05 hrs)	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	(05 hrs)	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. 5thEdition, 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, 4thEdition, ISBN-0-07-463879-3.
4. Gordon B. Davis, Margrethe H. Olson, "Management Information Systems: Conceptual Foundations, Structure and Development", Tata McGraw Hill Edition, 2ndEditon,ISBN-13:978-0-07-040267-6

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Unit I - Quiz	10
2	Unit II - Quiz	10
3	Unit III - Quiz	10
4	Unit IV - Assignment	10
5	Unit V - Assignment	10
	Total	**50**

T. Y. B. Tech. Artificial Intelligence and Data Science
Pattern 2023 Semester: V
2301309: Computer Organization and Architecture

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: - 2301206: Digital Electronics and Logic Design

Course Objectives:

- To get familiar with basics of computer organization and architecture
- To explain the function of elements of memory hierarchy and compare different methods for computer Input /Output
- To understand the concept of processor organization

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

	Course Outcomes	Bloom's Level
CO1	Explain the functions & organization of building blocks of computer	2- Understand
CO2	Illustrate processor instruction characteristics and concepts related to Assembly Language Programming	2- Understand
CO3	Explain characteristics of memory systems and I/O devices	2-Understand
CO4	Illustrate the organization of computer processor	2-Understand
CO5	Compare hardwired and micro programmed control unit	2-Understand

COURSE CONTENTS

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

Introduction to computer organization and architecture, Structure and Function, Computer components, Computer functions, Interconnection structure, Bus interconnection

Unit II	**Instruction Set**	**(08 hrs)**	**CO2**

Machine Instruction Characteristics, Type of operands, Addressing Modes, Types of operations: Data transfer, Arithmetic, Logical, Conversion, I/O , Transfer of Control, Introduction to assembly language

Unit III	**Memory and Input/output**	**(08 hrs)**	**CO3**

Memory: Characteristics of memory systems, The memory hierarchy, Cache memory principles, Elements of cache design: Direct, Associative Mapping, Memory replacement algorithms
Input/Output: I/O Modules, Programmed I/O, Memory mapped I/O, Interrupt driven I/O, Direct Memory Access

Unit IV	**Processor Organization**	**(08 hrs)**	**CO4**

Processor Organization, Register Organization, Instruction Cycle, Instruction Pipelining, Superscalar Vs Super pipelined, Design Issues

Unit V	**Control Unit**	**(06 hrs)**	**CO5**

Control Unit and its Operation: Micro operation, Control of the processor, Hardwired Implementation, Micro programmed Control: Microinstruction, Microinstruction sequencing and execution

Text Books

W. Stallings, "Computer Organization and Architecture: Designing for Performance", Eighth Edition, Prentice Hall of India, 2010, ISBN 13: 978-0-13-607373-4

Reference Books
1. C. Hamacher, V. Zvonko, S. Zaky, “Computer Organization”, Fifth edition, McGraw Hill, 2002, ISBN: 007-120411-3 2. Morris Mano, “Computer System Architecture”, PHI, Third Edition, ISBN- 81-7808-687-5

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Unit I - Quiz (10 marks and will be converted to 4 marks)	4
2	Unit II - Quiz (10 marks will be converted to 4 marks)	4
3	Unit III - Quiz (10 marks will be converted to 4 marks)	4
4	Unit IV - Assignment (10 marks and will be converted to 4 marks)	4
5	Unit V - Assignment (10 marks and will be converted to 4 marks)	4
	Total	**20**

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T. Y. B. Tech. Artificial Intelligence and Data Science
Pattern 2023 Semester: V
2311310: Project Based Learning

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

Course Objectives:

- To enable students to design innovative solutions for real-life problems through collaborative and critical thinking.
- To foster a hands-on, project-based learning approach that promotes lifelong learning and practical application.
- To develop teamwork and problem-solving skills required to address real-world technical challenges in multidisciplinary environments.

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

	Course Outcomes	**Bloom's Level**
CO1	Design solutions to real life problems and analyze its concerns through shared cognition.	3-Apply
CO2	Apply learning by doing an approach in PBL to promote lifelong learning.	3-Apply
CO3	Tackle technical challenges for solving real world problems with team efforts	3-Apply
CO4	Collaborate and engage in multi-disciplinary learning environments.	3-Apply

COURSE CONTENTS

This course is designed with weekly sessions consisting of one hour of tutorial and two hours of practical work. During tutorials, students will discuss key concepts, plan their projects, and clarify doubts. In practical sessions, students will actively work on their projects, apply their learning, and develop solutions in teams. Below are the weekly topics and activities outlined for tutorials and practical sessions.

Sr. No.	**Tutorial (1 Hour) – *Discussion Focus***	**Practical (2 Hours) – *Student Activities***
1	Course introduction, understanding PBL process, outcomes, and assessment criteria	Group formation, topic selection, idea generation
2	Identifying real-life problems, elements of innovation, and patentability	Finalize project topic and title, begin background study
3	Planning project stages, defining objectives and timeline	Prepare problem definition, requirement sheet, and Gantt chart
4	Introduction to design tools – concept maps, flowcharts, architecture diagrams	Create system architecture, identify modules/subtasks
5	Technical mentoring based on project domain (e.g., AI, Web, IoT)	Start prototype development or coding of first module
6	Guidelines for report writing – structure, formatting, and content	Continue implementation, prepare design and implementation report
7	Testing methods, demo presentation tips, communication skills	Perform testing, fix issues, rehearse project demonstration
8	Reflection on learning, teamwork review, ethical and social impact	Final project demonstration, report submission, review discussion
9	Testing techniques, debugging, and	Perform unit and integration testing,

	validation methods	document issues
10	Effective project demonstration and presentation skills	Rehearse demo, refine UI, prepare slides or posters
11	Ethical, social, and environmental considerations	Final report writing, include ethical impact statement
12	Self-assessment, peer feedback, final discussion	Final demonstration, submission of report and logbook

General Guidelines

1. Group Structure

Students will work in mentor-guided teams of 3 to 4 members to collaboratively plan and complete real-world projects.

2. Project/Problem Selection

Projects can be from any domain, preferably Computer Engineering. Ideas from first-year projects may be extended. Projects should focus on model development, software tools, and real-world relevance. Interdisciplinary, practical, and research-oriented problems are encouraged, including hands-on work, industry visits, and expert interactions.

3. Conduction

The mentor will monitor weekly progress and assess both individual and team contributions. Students are expected to show collaboration, self-motivation, and responsibility. Mentors and students must actively participate in evaluation, supported by institutional guidance and resources.

Evaluation and Continuous Assessment

Tutorial Evaluation (25 Marks)

- Participation in weekly discussions and reviews – 5 marks
- Maintenance of weekly logbook with progress updates – 5 marks
- Understanding of problem and project planning – 5 marks
- Presentation of progress during tutorials – 5 marks
- Self and peer assessment – 5 marks

Term Work Evaluation (25 Marks)

General Rubrics for Each Assignment (30 Marks)

- R1 – Timely Completion of Assignments (10 marks)
- R2 – Understanding of Assignment (10 marks)
- R3 – Presentation or Documentation (10 marks)

Text Books

1. Sharon J. Gerson, Steven M. Gerson, Technical Writing: Process and Product, Pearson Education Asia, ISBN :130981745, 4th Edition.
2. Andrea J. Rutherford, Basic Communication Skills for Technology, Pearson Education Asia, 2nd Edition.
3. Lesikar, Lesikar's Basic Business Communication, Tata McGraw, ISBN :256083274, 1st Edition.

Reference Books

1. Project-Based Learning, Edutopia, March 14,2016.
2. What is PBL? Buck Institute for Education.
3. www.schoology.com
4. www.howstuffworks.com

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

(Autonomous from Academic Year 2022-23)

TY B. Tech Artificial Intelligence and Data Science Pattern 2023 Semester: VI 2311311: Business Intelligence and Analytics		
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: - 2301303: Data Science and Big Data

Course Objectives:

- To introduce the concepts and frameworks of Business Intelligence (BI), Business Analytics, and Decision Support Systems.
- To provide a comprehensive understanding of data warehousing, including architectures, ETL processes, and data integration techniques.
- To develop the ability to model business problems using various analytical and structural modeling techniques within a BI context.
- To equip students with skills to create and interpret business reports, visualizations, and performance management tools like dashboards and balanced scorecards.
- To familiarize students with modern BI tools such as Power BI and Tableau, and explore their applications in various business functions and industries.

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

	Course Outcomes	**Bloom's Level**
CO1	Explain the fundamental concepts of business intelligence, business analytics, and decision support systems	2-Understanding
CO2	Compare various data warehousing architectures and their components	2-Understanding
CO3	Design BI models based on real-world data, incorporating relevant patterns and domain knowledge	3-Apply
CO4	Illustrate business reporting concepts, appropriate data visualizations, and implement basic performance measurement techniques	3-Apply
CO5	Compare features, use cases, and performance of Power BI and Tableau in business analytics	4-Analyze

COURSE CONTENTS

Unit I	**An Overview of Business Intelligence, Analytics, and Decision Support**	**(06 hrs)**	**CO1**

Business Intelligence (BI): Definition, framework, components, and process flow,
Business Analytics (BA): Types – Descriptive, Diagnostic, Predictive, Prescriptive,
Decision Support Systems (DSS): Introduction, characteristics, and evolution, Information Systems for Decision Making: Types (TPS, MIS, ESS, DSS), role in decisions, DSS Framework & Components: Gorry-Scott Morton model, classifications, capabilities.

Unit II	**Data Warehousing**	**(08 hrs)**	**CO2**

Data Warehousing Concepts – Definition, characteristics, benefits, and differences from OLTP, Data Warehousing Process Overview – Phases: planning, design, ETL, deployment, maintenance, Data Warehousing Architectures – Single-tier, two-tier, three-tier, OLAP types (ROLAP, MOLAP, HOLAP). Data Integration and ETL – Data extraction, transformation, loading techniques, data quality, Data Warehouse Development – Lifecycle approaches: top-down, bottom-up, hybrid, Implementation Issues –

Cost, complexity, data quality, scalability, success factors, Data Warehouse Administration – Metadata management, performance, backup, recovery, Security & Future Trends

Unit III	**Modeling in Business Intelligence**	**(10 hrs)**	**CO3**

Introduction to Models in BI – Definition, need for models, and their role in decision-making, Model Representation – How models represent real-world problems; abstraction techniques, Model Presentation – Techniques for presenting models (visual, mathematical, textual), Model Building – Steps in model creation, assumptions, and model design methodologies, Model Assessment & Quality – Evaluation metrics, accuracy, reliability, validation of models,Models and Patterns – Use of models to discover trends, relationships, and business patterns, Model Structures – Logical structures, algebraic models, graph models, and analytical models, Models and Data – Data generation, the role of time in modeling, and importance of data quality.

Unit IV	**Business Reporting, Visual Analytics, and Business Performance Management**	**(06 hrs)**	**CO4**

Business Reporting: Definition, purpose, and types of reports, Data and Information Visualization: Importance and objectives of visualization, Charts and Graphs: Common types—bar, line, pie, scatter, heatmaps, treemaps, Performance Dashboards: Design, types, and key features of dashboards, Business Performance Management (BPM): Overview and role in organizations, Performance Measurement: KPIs, metrics, and measurement techniques, Balanced Scorecards: Four perspectives and strategic use, Six Sigma: Concept, methodology, and role as a performance measurement system.

Unit V	**Tools and Applications**	**(06 hrs)**	**CO5**

Introduction to Business Analytics Tools: Overview of Power BI, Excel, and Tableau, Comparison: Power BI vs Excel vs Tableau – features and use cases, Power BI Ecosystem: Key components and their functions, Power BI Architecture and Workflow: Data ingestion, modeling, visualization, and sharing, Tableau Architecture and Workflow: Data connection, visualization, and dashboard creation, Applications of Business Intelligence: ERP, Operations, Inventory, HRM, CRM, Marketing, Logistics, Finance, Banking, Telecommunications, and Salesforce Management.

Text Books

1. Ramesh Sharda, Dursun Delen, EfraimTurban, J.E. Aronson,Ting-Peng Liang, David King, Business Intelligence and Analytics: System for Decision Support, 10th Edition, Pearson Global Edition, 2015
2. Grossmann W, Rinderle-Ma, Fundamental of Business Intelligence, Springer,
3. Thompson Carter, Data Visualization with Tableau and Power BI

Reference Books

1. Edward Mize, Data Analytics: The Ultimate Beginner's Guide to Data Analytics
2. Victor Finch, Data Analytics for Beginners: Your Ultimate Guide To Learn And Master Data Analysis. Get Your Business Intelligence Right – Accelerate Growth And Close More Sales ,
3. Introduction to business Intelligence and data warehousing", IBM, PHI
4. Rick Sherman, Elsevier Inc.,Business Intelligence Guidebook: From Data Integration to Analytics

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Unit I - Quiz (10 marks and will be converted to 4 marks)	4
2	Unit II - Quiz (10 marks will be converted to 4 marks)	4
3	Unit III - Written Test (10 marks will be converted to 4 marks)	4
4	Unit IV - Written Test(10 marks and will be converted to 4 marks)	4
5	Unit V - Presentation (10 marks and will be converted to 4 marks)	4
	Total	**20**

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

T. Y. B. Tech. Artificial Intelligence and Data Science
Pattern 2023 Semester: VI
2301312: 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: - 2301201: Discrete Structures

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) and Deterministic PDA (DPDA), PDA and Context Free Language, Equivalence of PDA and CFG, PDA vs 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

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Unit I - Assignment (10 marks and will be converted to 4 marks)	4
2	Unit II - Assignment (10 marks will be converted to 4 marks)	4
3	Unit III - Assignment (10 marks will be converted to 4 marks)	4
4	Unit IV - Quiz (10 marks and will be converted to 4 marks)	4
5	Unit V - Quiz (10 marks and will be converted to 4 marks)	4
	Total	**20**

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

T. Y. B. Tech. Artificial Intelligence and Data Science Pattern 2023 Semester: VI 2311313: Data Science Techniques and Tools Lab		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical : 02 hrs/week	**01**	**Continuous Comprehensive Termwork: 25 Marks Practical Exam :25 Marks**

Prerequisite Courses: - 2311303: Data Science and Big Data ,
2311304: Artificial Intelligence and Data Science Lab

Course Objectives:

- To understand exploratory data analysis
- To identify the tools used for data science analytics
- To understand the methodology for preprocessing, analyzing and visualizing big data.

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

	Course Outcomes	**Bloom's Level**
CO1	To make use of various data storage techniques for handling big data	2-Understand
CO2	Apply appropriate exploratory data analysis to gain insights from data	3-Apply
CO3	Apply Time series analysis on the given data set	3-Apply
CO4	Develop interactive dashboard for effective data visualization techniques	3-Apply
CO5	Analyze the process of integrating NoSQL databases with Business Intelligence tools for generating reports for decision making	4-Analyze

Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	Study the Hadoop ecosystem, its framework and components.	CO1
2	Perform Exploratory data analysis on web logs using Apache Spark. a. Compute statistics regarding the average, minimum, and maximum content sizes. b. Perform HTTP status code analysis to see which status code values appear and how many times. c. Analysing frequent hosts by getting the total count of accesses by each host, sorting by the number of accesses, and displaying only the top 10 most frequent hosts d. Display the top 20 most frequent endpoints	CO2

	e. Display the top 10 error endpoints f. How many unique hosts visited the website in two month g. Find the average number of requests made per host to the website per day h. Listing the top twenty 404 response code endpoints i. list of the top twenty hosts that generate the most 404 errors j. Visualizing 404 errors per day k. top three days of the month with the most 404 errors l. Visualizing hourly 404 errors Use Data Set : http://ita.ee.lbl.gov/html/contrib/NASA-HTTP.html	
3	Perform Time Series Analysis on data a. Import time series in python b. Visualizing time series c. Seasonal plot on time series d. Boxplot of Month-wise (Seasonal) and Year-wise (trend) Distribution e. Patterns in time series f. Perform additive and multiplicative time series g. Decompose a time series into its components h. Identify whether the time series is stationary or non-stationary i. Make a non-stationary series stationary j. Detrend a time series k. Deseasonalize a time series l. test for seasonality of a time series Use Data Set: https://raw.githubusercontent.com/selva86/datasets/master/a10.csv	CO3
4	Perform data visualization using Tableau /Power BI a. Connect any sales data source to Tableau b. Create basic charts such as line, bar charts, Tree maps using the Show me panel and get insights of the data.	CO4
5	Data analysis using Tableau Tableau /Power BI Load any sales data set of supermarkets and Perform analysis on sales using various aggregate functions like Sum, AVG,CORR,VAR, COVAR, STDDEV, Count, Max, Min.	CO2
6	Create a dashboard for sales data set and visualize sales in different locations and year wise sales.Add the interactive component to the dashboard like sales corresponding to a location of user selection will be displayed.(make use of filters)	CO4
7	Create a simple application that connects MongoDB to Power BI using an API to send data from MongoDB to Power BI for reporting.	CO5
8	Perform Exract Transform Load(ETL) using Power BI. a. import data into Power BI Desktop from the sample Northwind Datafeed(http://services.odata.org/V3/Northwind/Northwind.svc/) b. Remove unnecessary columns except ProductID, ProductName, UnitsInStock, and QuantityPerUnit c. Change the data type of the UnitsInStock column to whole number d. Expand the Order_Details table.i.e combine the table order and order_details into a single table	CO2

	e. Add a custom column field and name it as line_total and enter its value as [Order_Details.UnitPrice] * [Order_Details.Quantity]. f. Create a chart and visualize the data.	

Guidelines for Laboratory Conduction
Use of coding standards and Hungarian notation, proper indentation and comments. Use of open source software is to be encouraged. Installation of Hadoop, Apache Spark, Tableau, R, Power BI in Ubuntu is recommended
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 Artificial Intelligence and Data Science
Pattern 2023 Semester: VI
2301314A: User Interface and User Experience

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: -

Course Objectives:

- To study the usable software-enabled user-interfaces
- To achieve efficient, effective, and safe interaction
- To Explore various models and factors that affect response time
- 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	Understand the principles of User Interface	2 - Understand
CO2	Describe user experience fundamentals	2 - Understand
CO3	Explore strategies for managing design projects.	3 - Apply
CO4	Design user-friendly interaction styles and controls	3 - Apply
CO5	Test the usability of a design through usability evaluations	4 - Evaluate

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	(08 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	(06 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.", 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

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Unit I - Quiz (10 marks and will be converted to 4 marks)	4
2	Unit II - Assignment (10 marks will be converted to 4 marks)	4
3	Unit III - Assignment (10 marks will be converted to 4 marks)	4
4	Unit IV - Quiz (10 marks and will be converted to 4 marks)	4
5	Unit V - Presentation (10 marks and will be converted to 4 marks)	4
	Total	**20**

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

T. Y. B. Tech Artificial Intelligence and Data Science Pattern 2023 Semester: VI 2311314B: Neural Network and Fuzzy Logic		
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 concept of neuron and Artificial neural network
- To study different neural network learning rules and factors
- To get acquainted to the concept of Single layer and multi layer neural network
- To acquire the knowledge of fuzzy sets and fuzzy logic.
- To learn the concepts of fuzzy systems.

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

	Course Outcomes	**Bloom's Level**
CO1	Explain the concept of artificial neural networks	2-Understand
CO2	Illustrate the concept of neural network learning	2-Understand
CO3	Describe the architecture of single layer and multi layer neural network	2-Understand
CO4	Illustrate the concepts of fuzzy sets and fuzzy logic	2-Understand
CO5	Explain the concepts of fuzzy systems	2-Understand

COURSE CONTENTS

Unit I	**Introduction To Neural Networks**	**(07 hrs)**	**CO1**

Biological Neuron, McCulloch-Pitts Neuron Model, Neuron Modeling for Artificial Neural Systems, Models of Artificial Neural Networks- Feed-forward Network, Feedback Network, Neural Processing, Learning and Adaptation- Supervised and Unsupervised Learning

Unit II	**Neural Network Learning Rules and Factors**	**(07 hrs)**	**CO2**

Hebbian Learning Rule, Perceptron Learning Rule, Delta Learning Rule, Widrow-Hoff Learning Rule, Correlation Learning Rule, Winner-Take-All Learning Rule Learning factors: Initial weights, Cumulative verses incremental weight updating, Steepness of activation function, learning constant and Momentum

Unit III	**Single Layer and Multi Layer Neural Network**	**(08 hrs)**	**CO3**

Single layer perception, Multilayer feed forward networks and Its architecture, Training neural networks, Back propagation learning Activation functions: Linear, Sigmoid, Tanh, Hard Tanh, Softmax, Rectified linear Loss Functions for regression, Loss Functions for classification, Loss Functions for reconstruction Hyper parameters: Learning rate, regularization, Momentum, Sparsity

Unit IV	**Fuzzy Sets and Logic**	**(07 hrs)**	**CO4**

Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy arithmetic, Fuzzy relations, Characteristic of membership functions, Membership functions, Fuzzy logic, Fuzziness and Probability

Unit V	Fuzzy Systems	(07 hrs)	CO5
Fuzzy Controller, Fuzzy rule base and approximate reasoning: truth values and tables in fuzzy logic, fuzzy propositions formation of rules Fuzzy Logic: Linguistics Variables and Hedges, Fuzzy Rules. Fuzzy Inferencing: neuro inferencing, Fuzzification, Defuzzification Fuzzy logic Controllers: Fuzzy logic Controllers, Fuzzy logic Types			

Text Books

1. Josh Patterson and Adam Gibson,"Deep Learning – A practitioners approach", O'Reilly Publication, First Edition, ISBN- 978-93-5213-604-9
2. Jacek M. Zurada, "Introduction to Artificial Neural Systems" West Publishing Company, ISBN 0-3 14-93391 -3
3. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing A Computational Approach to Learning and Machine Intelligence", Prentice Hall, ISBN: 978-0132610667
4. S.Rajasekaran, and G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms : Synthesis, and Applications", Prentice Hall of India

Reference Books

1. Nikola K. Kasabov, "Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering", MIT Press, ISBN:978-0-262-11212-3
2. Andries P. Engelbrecht, "Computational Intelligence: An Introduction", 2nd Edition-Wiley India-ISBN: 978-0-470-51250-0

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Unit I - Assignment (10 marks and will be converted to 4 marks)	4
2	Unit II - Assignment (10 marks will be converted to 4 marks)	4
3	Unit III - Assignment (10 marks will be converted to 4 marks)	4
4	Unit IV - Quiz (10 marks and will be converted to 4 marks)	4
5	Unit V - Quiz (10 marks and will be converted to 4 marks)	4
	Total	**20**

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

T. Y. B. Tech. Artificial Intelligence and Data Science
Pattern 2023 Semester: VI
2311314C : Web Technology

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: - Database Management Systems(2311212)
Database Management Systems Lab(2311215)
Object-Oriented Programming Lab(2311214)

Course Objectives:

- To understand the fundamentals of modern web technologies.
- To develop user-friendly and responsive interfaces using web tools.
- To create dynamic and data-driven web applications suitable for AI/DS contexts.
- To connect front-end interfaces with back-end services and databases.

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

	Course Outcomes	Bloom's Level
CO1	Describe the architecture and components of modern web development	2-Understand
CO2	Design interactive and responsive web pages using HTML, CSS, and JavaScript	3-Apply
CO3	Use frontend libraries like React or Bootstrap for dynamic content	3-Apply
CO4	Develop backend APIs using Node.js and Express for data handling	3-Apply
CO5	Integrate MongoDB for data storage and deploy applications on cloud platforms	3-Apply

COURSE CONTENTS

This course is designed with weekly sessions consisting of three hours of theory lectures. During these sessions, students will explore essential concepts, tools, and workflows involved in modern web development. The course emphasizes practical understanding through five structured assignments, each aimed at helping students design, develop, and integrate various components of a web application. These assignments progressively build students' capabilities in frontend design, backend development, database integration, and deployment.

Unit I	Introduction to Web Development	(03 hrs)	CO1

Basics of web: frontend, backend, database, Web application structure and client-server model, Tools: VS Code, Git, Postman, GitHub, Overview: HTML, CSS, JavaScript, Node.js, Express, MongoDB

Unit II	HTML, CSS, and JavaScript Essentials	(06 hrs)	CO2

HTML5: structure, forms, semantic tags,CSS3: styling, responsive layout (Flexbox, Grid),JavaScript: functions, events, DOM manipulation, Basics of responsive and user-centric design

Unit III	Frontend Libraries (React.js / Bootstrap)	(06 hrs)	CO3

Components, props, state in React, Bootstrap components for layout, Routing and navigation,Building interactive dashboards (AI-focused use cases)

Unit IV	Backend with Node.js and Express	(06 hrs)	CO4

Node.js basics and server setup, Express.js: routes, middleware, RESTful APIs and CRUD operationsTesting APIs using Postman

Unit V	Database and Deployment	(06 hrs)	CO5

Introduction to NoSQL and MongoDB,Mongoose for schema and queries,Connecting frontend-backend-database,Deployment on Vercel, Render, Netlify

General Guidelines

Students are expected to maintain a detailed lab journal documenting all assignments, including a certificate page, table of contents, and handwritten write-ups. Each entry should clearly state the assignment title, problem statement, key concepts, system or data flow diagrams, step-by-step implementation, and test cases with expected results. Program codes along with sample outputs must be submitted separately in soft copy. Throughout the course, students should use open-source tools and recommended IDEs, follow best coding practices with clean, well-commented, and organized code, and employ version control systems like Git for collaboration. This structured approach ensures better understanding, effective project management, and smooth integration of frontend and backend components in full stack development.

Guidelines for Term work Assessment

The continuous assessment of laboratory work will be based on the student's overall performance throughout the term. Each laboratory assignment will be evaluated using a rubric that considers three key criteria:

- R1: Timely completion of the assignment (10 marks)
- R2: Understanding and comprehension of the assignment (10 marks)
- R3: Presentation quality and clarity of the journal write-up (10 marks)

This approach ensures a fair and comprehensive evaluation of both practical skills and documentation.

Text Books

1. Jon Duckett, *"Web Design with HTML, CSS, JavaScript and jQuery Set"*, Wiley, 1st Edition (2014)
2. Nicholas C. Zakas, *"Professional JavaScript for Web Developers"*, Wrox (Wiley), 3rd Edition (2012)
3. Ethan Brown, *"Web Development with Node and Express: Leveraging the JavaScript Stack"*, O'Reilly Media, 2nd Edition (2019)

Reference Books

1. Brad Dayley, Brendan Dayley, Caleb Dayley, "Node.js, MongoDB and Angular Web Development", Addison-Wesley Professional, 2nd Edition (2017)
2. Azat Mardan, "Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB", Apress, 1st Edition (2015)
3. Chris Minnick and Eva Holland, "Beginning HTML5 and CSS3 for Dummies", Wiley, 1st Edition (2013)
4. Eric Freeman and Elisabeth Robson, "Head First HTML and CSS", O'Reilly Media, 2nd Edition (2012)
5. Eric Elliott, "Programming JavaScript Applications: Robust Web Architecture with Node, HTML5, and Modern JS Libraries", O'Reilly Media, 1st Edition (2014)

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Unit I - Quiz (10 marks and will be converted to 4 Marks)	4
2	Unit II - Quiz (10 marks will be converted to 4 Marks)	4
3	Unit III - Written Test (10 marks will be converted to 4 Marks)	4
4	Unit IV - Written Test(10 marks and will be converted to 4 Marks)	4
5	Unit V - Presentation (10 marks and will be converted to 4 Marks)	4
	Total	**20**

K.K.Wagh Institute of Engineering Education and Research, Nashik
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TY B. Tech Artificial Intelligence and Data Science Pattern 2023 Semester: VI 2301315A: 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: - 2301216 Data Communications & Networking

Course Objectives:

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

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

	Course Outcomes	**Bloom's Level**
CO1	Explain the fundamental concepts and architecture of cloud computing	2-Understand
CO2	Describe various enterprise and cloud storage systems and their role in distributed data management.	2-Understand
CO3	Summarize the concepts of virtualization, its types, architecture, and its integration with cloud computing infrastructure.	2-Understand
CO4	Illustrate how cloud platforms like AWS and Google Cloud support real-world applications in fields	2-Understand
CO5	Discuss the risks, challenges, and security measures related to data confidentiality, integrity, and availability in the cloud.	2-Understand

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**	**(06 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) Cloud Storage from LANs to WANs: Cloud Characteristics, 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. Grid, Cloud and 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: Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Geosciences: Satellite Image Processing, Business and Consumer Applications: CRM and ERP, Social Networking, Google Cloud Application: Google App Engine.Overview of OpenStack architecture.

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

Risks in Cloud Computing: Risk Management, Enterprise-Wide Risk Management, Types of Risks in Cloud Computing. 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.

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

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Unit I - Quiz (10 marks and will be converted to 4 marks)	4
2	Unit II - Quiz (10 marks will be converted to 4 marks)	4
3	Unit III - Written Test (10 marks will be converted to 4 marks)	4
4	Unit IV - Written Test(10 marks and will be converted to 4 marks)	4
5	Unit V - Presentation (10 marks and will be converted to 4 marks)	4
	Total	**20**

K.K.Wagh Institute of Engineering Education and Research, Nashik
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T. Y. B. Tech. Artificial Intelligence and Data Science **Pattern 2023 Semester: VI** **2301315B: 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: - 2301201: Discrete Structures

Course Objectives:

- To be familiar with fundamental concepts and techniques of Natural Language Processing (NLP)
- To acquire the knowledge of various morphological, syntactic, and semantic NLP tasks
- To use appropriate tools and techniques for processing natural languages
- To describe applications of NLP and Machine Translations

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

	Course Outcomes	**Bloom's Level**
CO1	Describe the fundamental concepts of NLP, challenges and issues in NLP	2-Understand
CO2	Describe the concepts of morphology, syntax, semantics of natural languages	2-Understand
CO3	Analyze and study natural language logically	2-Understand
CO4	Apply information retrieval techniques	3. Apply
CO5	Develop real world NLP applications	3. Apply

COURSE CONTENTS

Unit I	**Introduction to NLP**	**(08 hrs)**	**CO1**

Introduction: Natural Language Processing, Why NLP is hard? Programming languages Vs Natural Languages, Are natural languages regular? Finite automata for NLP, Stages of NLP, Challenges and Issues(Open Problems) in NLP
Basics of text processing: Tokenization, Stemming, Lemmatization, Part of Speech Tagging

Unit II	**Word Level and 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. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing,
Word Sense Disambiguation: Lesk Algorithm Walker's algorithm, WordNets for Word Sense Disambiguation

Morphological Analysis: What is Morphology? Types of Morphemes, Inflectional morphology & Derivational morphology, Morphological parsing with Finite State Transducers (FST)

Syntactic Analysis: Syntactic Representations of Natural Language, Parsing Algorithms, Probabilistic context-free grammars, and Statistical parsing

Unit III	Semantic Analysis Language Modelling	(06hrs)	CO3

Semantic Analysis: Lexical Semantic, Relations among lexemes & their senses –Homonymy, Polysemy, Synonymy, Hyponymy, WordNet, Dictionary based approach, Latent Semantic Analysis
Discourse Processing: Introduction, Cohesion, Reference Resolution, Discourse Coherence and Structure Probabilistic language modeling, Markov models, Generative models of language, Log-Linear Models, Graph-based Models
N-gram models: Simple n-gram models, Estimation parameters and smoothing, Evaluating language models, Word Embeddings/ Vector Semantics: Bag-of-words, TFIDF, word2vec, doc2vec, Contextualized representations (BERT)
Topic Modelling: Latent Dirichlet Allocation (LDA), Latent Semantic Analysis, Non Negative Matrix Factorization

Unit IV	Information retrieval, NLP Tools and Techniques	(08hrs)	CO4

Information Retrieval: Introduction, Vector Space Model, Design features of Information Retrieval Systems, Models of Information Retrieval
Named Entity Recognition: NER System Building Process, Evaluating NER System
Entity Extraction, Relation Extraction, Reference Resolution, Coreference resolution, Cross Lingual Information Retrieval
Prominent NLP Libraries: Natural Language Tool Kit (NLTK), spaCy, TextBlob, Gensim etc. Linguistic Resources: Lexical Knowledge Networks, WordNets, Indian Language WordNet (IndoWordnet), VerbNets, PropBank, Treebanks, Universal Dependency Treebanks

Unit V	Applications of NLP	(06 hrs)	CO5

Machine Translation: Rule based techniques, Statistical Machine Translation (SMT), Cross Lingual Translation
Sentiment Analysis, Chatbots and Virtual Assistants, Question Answering, Text Entailment, Named Entity Recognition (NER), Discourse Processing, Dialog and Conversational Agents,Text Summarization, Grammar and Spell Checking, Natural Language Generation

Text Books

1. U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Jurafsky, David, and James H. Martin, —Speech and Language Processing: An Introduction to Natural Language Processing‖, Computational Linguistics and Speech Recognition‖, , PEARSON Publication
3. Manning, Christopher D., and nrich Schütze , —Foundations of Statistical Natural Language Processing‖, Cambridge, MA: MIT Press

Reference Books

1. Allen James, Natural Language Understanding, Pearson India, 2nd Edition ISBN: 9788131708958, 8131708950
2. James H. Martin, Daniel Jurafsky, Speech and Language Processing Pearson 1stAddition, ISBN 9789332518414
3. Steven Bird, Ewan Klein, Edward Loper, —Natural Language Processing with Python – Analyzing

Text with the Natural Language Toolkit‖, O'Reilly Publication
4. Alexander Clark, Chris Fox, and Shalom Lappin, —The Handbook of Computational Linguistics and Natural Language Processing‖, Wiley Blackwell Publications
5. Jacob Eisenstein, —Natural Language Processing‖, MIT Press
6. Jacob Eisenstein, —An Introduction to Information Retrieval‖, Cambridge University Press

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	3
CO2	3	2	2	2	-	2	-	-	-	-	-	2	3	3
CO3	3	2	2	-	-	2	-	-	-	-	-	2	3	3
CO4	3	3	3	-	-	2	-	-	-	-	-	2	3	3
CO5	3	3	3	3	-	2	-	-	-	-	-	2	3	3
Average	3	2.5	2.5	2.5	-	2	-	-	-	-	-	2	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 each of 15 marks (Total marks will be converted to 15 Marks)	15
2	Theory assignment on Unit-3 and 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 Artificial Intelligence and Data Science Pattern 2023 Semester: VI 2311315C: Cyber Security		
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: - 2301216: Data Communications & Networking

Course Objectives:

- To understand the concepts of cryptography
- To understand the principles of cyber security
- To acquire knowledge of standard algorithms and protocols used to provide confidentiality, integrity and authenticity
- To enhance awareness about personal identifiable information, information management and cyber forensics

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

	Course Outcomes	**Bloom's Level**
CO1	Explain fundamental concepts and approaches in cyber security.	2-Understand
CO2	Elaborate the security protections and limitations provided by existing Data Encryption Techniques	2-Understand
CO3	Illustrate Public key Cryptography and its Management	2-Understand
CO4	Explain secure communication and perimeter-defense mechanisms	2-Understand
CO5	Identify Cyber Security framework and current trends	2-Understand

COURSE CONTENTS

Unit I	**Introduction to cyber security**	**(06 hrs)**	**CO1**

Authentication, Access Control and Cryptography, Threats, Harm, Vulnerabilities, Security Attacks : Active and passive Web attack: Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks, Network Vulnerabilities: Overview of vulnerability scanning, Open Port /Service Identification, Banner /Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples

Unit II	**Data Encryption Techniques and Standards**	**(08 hrs)**	**CO2**

Encryption Methods: Symmetric, Asymmetric Cryptography, Substitution Techniques: Caesar Cipher, Monoalphabetic Ciphers, Play fair Cipher, Hill Cipher, Poly alphabetic Ciphers, Transposition Techniques, Block Ciphers, Stream Cipher, Data Encryption standards, Triple DES, Advanced Encryption standards

Unit III	**Public Key and Management**	**(08 hrs)**	**CO3**

Public Key Cryptography RSA Algorithm: Working, Key length, Security, Key Distribution, Deffie-Hellman Key Exchange, Elliptic Curve, Authentication methods, Message Digest, Kerberos, X.509 Authentication service. Digital Signatures: Implementation, Algorithms, Standards (DSS), Authentication Protocol.

Unit IV	**Secure Communication Protocols & Network Defense**	**(06 hrs)**	**CO4**

IPsec overview – Purpose, SA,AH Protocol, ESP Protocol **VPN types**-site-to-site, remote TLS-VPN in one slide, **TLS / SSL fundamentals** – handshake & record concepts, **E-mail security** – PGP,NGFW S/MIME comparison, Secure Electronic Transaction, **Firewalls** Goals, packet, stateful,
I**ntrusion Detection & Prevention** – signature, anomaly, NIDS/HIDS

Unit V	**Governance, Ethics & Industry Perspectives**	**(08 hrs)**	**CO5**

Cyber-security Framework, Purpose of risk & control frameworks,NIST CSF 2.0 – six functions, outcome categories, profiles, ISO/IEC 27001:2022 – clauses 4-10, Annex A control themes, certification cycle, Cyber Ethics & Legal Compliance IT Act 2000 structure and penalties, Indian case studies (e-payment fraud, data leak),GDPR principles, India's Digital Personal Data Protection Act 2023 – rights, penalties Ethical dilemmas, responsible disclosure, privacy vs surveillance
Emerging Trends: Zero-Trust, AI-driven defense, IoT security, quantum-ready crypto
Role landscape: SOC analyst, GRC specialist, cloud-security architect, red/blue/purple teams

Text Books

1. William Stallings, "Cryptography and Network Security: Principles and Practice", 7/e, Pearson,ISBN:9789332585225.https://pearsoned.co.in/web/books/9789332585225_Cryptography-and-Network-Security_William-Stallings.aspx
2. Dr. V.K. Pachghare, Cryptography and Information Security, PHI, ISBN 978-81-303- 5082-3
3. Nina Godbole,SunitBelapure, Cyber Security,Wiley India, ISBN:978-81-345-2179-1
4. National Institute of Standards and Technology (NIST), "The NIST Cybersecurity Framework (CSF) 2.0", CSWP-29, NIST, DOI: 10.6028/NIST.CSWP.29.

Reference Books

1. Atul Kahate, "Cryptography and Network Security", Mc Graw Hill Publication, 2nd Edition, 2008, ISBN : 978-0-07-064823-4
2. Stuart McCLURE, Joel Scambray, George Kurtz, Hacking Exposed Network Security Secrets and Solutions, McGrowHill, 2012 ISBN: 978-0-07-178028-5 Digital Ref:http://84.209.254.175/linux-pdf/Hacking-Exposed-7-Network-Security-Secrets.pdf

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Unit I - Quiz (10 marks and will be converted to 4 marks)	4
2	Unit II - Assignment (10 marks will be converted to 4 marks)	4
3	Unit III - Assignment (10 marks will be converted to 4 marks)	4
4	Unit IV - Quiz (10 marks and will be converted to 4 marks)	4
5	Unit V - Quiz (10 marks and will be converted to 4 marks)	4
	Total	**20**

K. K. Wagh Institute of Engineering Education and Research, Nashik
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T. Y. B. Tech. Artificial Intelligence and Data Science Pattern 2023 Semester: VI 2311316: Programming Lab		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 02 Hrs	**01**	**Termwork : 25 Marks Practical Exam: 25 Marks**
Prerequisite Courses: -		

Course Objectives:

- To study the fundamentals in selected elective subjects.
- 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	Course Outcomes	Bloom's Level
	2301314A:User Interface and User Experience	
1	Apply UI/UX design tools like Wireframe, Mockup, and Figma to identify user-specific needs	3-Apply
2	Use effective user interfaces / user experiences	3-Apply
	2311314B: Neural Network and Fuzzy Logic	
1	Construct simple artificial neural networks using appropriate tools and frameworks.	3-Apply
2	Apply the concepts of Neural Network and Fuzzy Logic for various real world problems	3-Apply
	2311314C : Web Technology	
1	Build responsive and interactive frontend web pages using HTML, CSS, JavaScript, or modern frameworks like React.js and Vue.js.	3-Apply
2	Develop RESTful backend APIs, perform database operations, and integrate frontend with backend services to deploy complete web applications.	3-Apply
	2301315A: Cloud Computing	
1	Apply tools and techniques in the area of Cloud Computing	3-Apply
2	Apply cloud computing services for problem solving	3-Apply
	2301315B: Natural Language Processing	
1	Apply text pre-processing techniques on given text.	3-Apply
2	Apply syntactic analysis on given text	3-Apply
	2301315C: Cyber Security	
1	Identify the vulnerabilities and design a security Solutions	3-Apply
2	Implement symmetric and asymmetric key algorithms	3-Apply

Guidelines for Student's Laboratory 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).
Guidelines for Laboratory Conduction
Encourage the use of open-source software and widely accepted industry tools to promote hands-on skills. Recommended Softwares: Figma (Free), Penpot (Open-source, HTML/CSS/JS, CloudSim, KVM (Linux), VirtualBox, Google Cloud Platform (Free Tier), AWS Educate, OpenStack, Salesforce Dev, NLTK, spaCy, gensim, scikit-learn, NLP, Google Colab, VS Code, Git, Postman, Node.js

Suggested List of Laboratory Experiments/Assignment		
Sr. No.	**All assignments are compulsory**	**COs**
	2301314A: User Interface and User Experience Design	
1	Apply UI/UX design tools such as Wireframe, Mockup, and Figma to study a selected product/system, identify specialized user needs and associated facilities, and suggest improvements for enhanced 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
	2301314B: Neural Network and Fuzzy Logic	
1	Write a Python program to plot a few activation functions that are being used in neural networks.	CO3,CO4
2	Python program illustrating the training process of a neural network using TensorFlow/PyTorch, emphasizing forward propagation and backpropagation.	CO3,CO4
3	Implementation of Fuzzy Operations.	CO3,CO4
4	Design and implement a fuzzy inference system	CO3,CO4
	2301314C: Web Technology	
1	**Environment Setup and Requirement Gathering** ➢ Install tools: VS Code, Git, Postman, Node.js ➢ Choose frontend technology: **Option A:** Vanilla HTML, CSS, JavaScript **Option B:** React.js **Option C:** Vue.js ➢ Choose backend technology: **Option A:** Node.js with Express **Option B:** Any other backend framework allowed by instructor (optional) ➢ Identify a client/organization needing a website. ➢ Collect and document requirements.	CO1
2	**Build Basic Frontend Page**	CO1

K. K. Wagh Institute of Engineering Education and Research, Nashik
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T. Y. B. Tech. Artificial Intelligence and Data Science
Pattern 2023 Semester: VI
2301317: 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: - 2301206: Digital Electronics and Logic Design

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 Systems**	**(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

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Unit I - Quiz (10 marks and will be converted to 4 marks)	4
2	Unit II - Quiz (10 marks will be converted to 4 marks)	4
3	Unit III - Quiz (10 marks will be converted to 4 marks)	4
4	Unit IV - Assignment (10 marks and will be converted to 4 marks)	4
5	Unit V - Assignment (10 marks and will be converted to 4 marks)	4
	Total	**20**

TY B.Tech Artificial Intelligence and Data Science
Pattern 2023 Semester: VI
2301318: Project Planning and Management

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

Prerequisite Courses: - 2301213: Software Engineering

Course Objectives

- To understand the fundamentals of project management and life cycle phases.
- To develop skills in planning, scheduling, and controlling software projects.
- To introduce tools and techniques used in project estimation and monitoring.
- To provide awareness on risk and quality management in software projects.
- To introduce contemporary approaches like Agile and DevOps for project execution.

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

	Course Outcomes	Bloom's Level
CO1	Describe the phases and characteristics of project management life cycle	2 – Understand
CO2	Apply estimation techniques and schedule a project using charts and tools	3 – Apply
CO3	Identify and manage risks and ensure quality in software projects	3 – Apply
CO4	Use project management tools for tracking progress and performance	3 – Apply
CO5	Explain modern methodologies like Agile, Scrum, and DevOps in project execution	2 – Understand

COURSE CONTENTS

Unit I	Introduction to Project Management	(04 hrs)	CO1

Definition and characteristics of a project, Project Life Cycle and Process Groups, Role of Project Manager and Stakeholders

Self-study: Triple Constraint (Scope, Time, Cost)

Unit II	Project Planning and Estimation	(05 hrs)	CO2

Project Scope Management and WBS, Effort estimation techniques: Function Point, Use Case, COCOMO-II, Activity scheduling using Gantt Charts, Network Diagrams, Critical Path Method (CPM) and PERT

Unit III	Risk and Quality Management	(05 hrs)	CO3

Risk Identification, Analysis and Mitigation, Software Quality Assurance and Control, Quality Standards: ISO, CMMI

Self-study: Risk Register and Case Study Analysis

Unit IV	Project Monitoring and Tools	(05 hrs)	CO4

Progress and Performance Tracking, Earned Value Management (EVM), Project Management Tools: MS Project, JIRA, Trello, Project Communication and Reporting

Unit V	Agile and Contemporary Practices	(05 hrs)	CO5

Agile Project Management: Principles and Manifesto, Scrum Framework: Roles, Ceremonies, Artifacts Kanban, Extreme Programming (XP), DevOps Practices in Project Execution

Text Books

1. Bob Hughes, Mike Cotterell, Rajib Mall, Software Project Management, 6/e, McGraw Hill Education
2. Kathy Schwalbe, Information Technology Project Management, 8/e, Cengage Learning
3. Pankaj Jalote, Software Project Management in Practice, Pearson Education

Reference Books
1. Harold Kerzner, Project Management: A Systems Approach to Planning, Scheduling, and Controlling, Wiley 2. S.A. Kelkar, Software Project Management, PHI Learning 3. Agile Practice Guide, Project Management Institute (PMI)

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Unit I - Quiz	10
2	Unit II - Quiz	10
3	Unit III - Quiz	10
4	Unit IV - Assignment	10
5	Unit V - Assignment	10
	Total	**50**

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

T.Y. B. Tech. Artificial Intelligence and Data Science Pattern 2023 Semester: V1 2311319: Mobile Application Development		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Tutorial: 01 hr/week Practical: 02 hrs/week	**02**	**Tutorial : 25 Marks Oral : 25 Marks**

Prerequisite Courses: -

Course Objectives:

- To understand various mobile application development technologies and architectures including native and hybrid platforms.
- To identify the tools, SDKs, IDEs, and configuration files required for mobile application development.
- To design and implement structured mobile applications using modular components such as screens, fragments, and views.
- To apply interactivity tools like intents, adapters, dialogs, menus, and notifications to enhance user experience.
- To implement persistent data handling in mobile applications using local databases and CRUD operations.
- To integrate location-based services and to examine security and deployment best practices in mobile applications.

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

	Course Outcomes	**Bloom's Level**
CO1	Describe mobile development technologies, architectures, development tools, and build a basic mobile application.	2-Understanding
CO2	Design and build structured mobile applications using modular components and view hierarchies.	3-Apply
CO3	Implement interactive UI features such as navigation, dialogs, menus, and notifications.	3-Apply
CO4	Develop data-driven mobile applications using local databases and CRUD operations	3-Apply
CO5	Integrate location-based services and apply mobile application security and deployment best practices.	3-Apply

COURSE CONTENTS

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

Overview of mobile application development technologies and architectures including native (iOS, Windows), and hybrid platforms. Overview of software development kits (SDKs), integrated development environments (IDEs), and mobile app configuration files. Introduction to setting up development environments and creating a basic mobile application.

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

Creating a new mobile project using supported tools. Understanding project structure, components, screen lifecycle, modular components (e.g., fragments), and view hierarchies.

Unit III	Interactivity Tools	(02 hrs)	CO3
Implementation of interactivity features such as message passing/navigation (intents), data display mechanisms (adapters), user dialogs, menu systems, and notification handling.			
Unit IV	**Interaction with Database**	**(02 hrs)**	**CO4**
Working with local mobile databases (e.g., SQLite or equivalent). Handling data using cursors/content handlers and performing standard CRUD (Create, Read, Update, Delete) operations.			
Unit V	**Security and Application Deployment**	**(02 hrs)**	**CO5**
Incorporating location-based services using map APIs, displaying and controlling map features, obtaining real-time location data. Understanding platform-specific security models and best practices for secure application deployment			

Text Books

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)
2. Bonnie Eisenman, "Learning React Native Building Native Mobile Apps with JavaScript", O'Reilly Media, October 23, 2017.

Reference Books

1. Meier, Reto, Professional Android 4 Application Development, Wiley Education
2. Lee, Wei- Meng, Beginning Android 4 Application Development, Wiley Education
3. Delessio, Carmen; Darcey, Lauren; Conder, Shane, Android application Development: in 24 hours, Pearson Education
4. Neil Smith, Android by Dixit, Prasanna Kumar - Vikas Publishing House Android Studio Development Essentials Book
5. Nader Dabit, React Native in Action: Developing iOS and Android apps with JavaScript, Manning Publications

Sr. No.	List of Laboratory Assignments/ Experiments	COs Mapped
1	Installation of IDE required for Mobile Application Development.	CO1
2	Create an application that can print a message "Welcome to KKWIEER".	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 form that has input boxes for user name, password, address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Drop Down), Skill sets (check box) and a Submit button. On clicking the submit button, print all the data below the Submit Button (use any layout).	CO3
5	Develop and deploy a mobile application (mini project) utilizing Location-Based Services. Ensure the app follows the security model using appropriate mobile application development tools/technologies. **Note: Students may develop the project using any tools and frameworks commonly used for mobile application development, such as Android Studio, React Native, Flutter, or equivalent platforms**	CO2,CO3,CO4, CO5

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T. Y. B. Tech Artificial Intelligence and Data Science Pattern 2023 Semester: VI 2311320: Research Seminar		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 02 hrs/week	**01**	**Term Work: 50 Marks**

Prerequisite Courses: - Basics of literature survey, technical writing, and communication skills

Course Objectives

- To explore recent trends and research developments in computer engineering.
- To develop skills in identifying and reviewing quality research literature.
- To improve skills in technical report writing and formal presentation.
- To foster independent thinking and scholarly discussion among students.
- To encourage ethical practices in research and academic integrity.

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

	Course Outcomes	**Bloom's Level**
CO1	Identify a relevant research topic and formulate objectives	3 – Apply
CO2	Survey and critically review published research literature	4 – Analyze
CO3	Prepare a structured technical report using proper citations	3 – Apply
CO4	Present technical content clearly and respond to peer/faculty queries	3 – Apply
CO5	Demonstrate ethical research practices and academic honesty	2 – Understand

Seminar Guidelines

- Each student shall select a research topic in consultation with a faculty guide.
- The topic must be relevant to current trends in computer engineering or interdisciplinary areas.
- Students must perform a comprehensive literature survey using reputed journals and conference papers.
- Each student must submit a well-documented seminar report following standard formatting guidelines (IEEE/ACM).
- Students must deliver a PowerPoint-based seminar presentation in front of a review panel.
- Evaluation will be based on continuous assessment, quality of report, and final presentation.

Guidelines for Termwork Assessment

Assessment will be based on:

1. Topic Selection & Synopsis (Relevance, Innovation, Clarity of Objectives) – 10 Marks
2. Literature Survey (Coverage, Analysis, Proper Referencing) - 10 Marks
3. Seminar Report (Structure, Formatting, Plagiarism-Free) - 10 Marks
4. Presentation Delivery (Content, Clarity, Confidence, Handling Q&A) - 10 Marks
5. Overall Participation & Timeliness (Progress, Regularity, Faculty Feedback) - 10 Marks