



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

Curriculum

T.Y. B.Tech.

Information Technology

w.e.f.: AY 2025-2026

(2023 Pattern)

T.Y. B. Tech w.e.f. AY 2025-26															
SEM-V															
Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TUT/TW	PR/OR	TOTAL	TH	TU	PR	TOTAL
2308301	PCC	Theory of Computation	3	-	-	20	60	20	-	-	100	3	-	-	3
2308302	PCC	Operating Systems	3	-	-	20	60	20	-	-	100	3	-	-	3
2308303	PCC	Machine Learning	3	-	-	20	60	20	-	-	100	3	-	-	3
2308304	PCC	Operating Systems Lab	-	-	2	-	-	-	25	25	50	-	-	1	1
2308305	PCC	Machine Learning Lab	-	-	2	-	-	-	25	25	50	-	-	1	1
2308306A 2308306B	PEC	Internet of Things / Design and Analysis of Algorithms	3	-	-	20	60	20	-	-	100	3	-	-	3
2308307A 2308307B	PEC	Internet of Things Lab/ Design and Analysis of Algorithms Lab	-	-	2	-	-	-	25	25	50	-	-	1	1
2308308	OE	IPR and Patents	2	-	-	-	-	50	-	-	50	2	-	-	2
2308309	MDM	Data Communication	3	-	-	20	60	20	-	-	100	3	-	-	3
2308310	CEP	Project Based Learning	-	1	2	-	-	-	TU-25 TW-25	-	50	-	1	1	2
Total			17	01	08	100	300	150	125	75	750	17	1	4	22

T.Y. B. Tech wef AY 2025-26															
SEM-VI															
Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSE M	ENDSE M	CCE	TU /TW	PR /OR	TOTAL	TH	TU	PR	TOTAL
2308311	PCC	Software Engineering and Project Management	3	-	-	20	60	20	-	-	100	3	-	-	3
2308312	PCC	Data Science and Big Data Analytics	3	-	-	20	60	20	-	-	100	3	-	-	3
2308313	PCC	Data Science and Big Data Analytics Lab	-	-	2	-	-	-	25	25	50	-	-	1	1
2308314A 2308314B 2308314C	PEC	Artificial Intelligence and Neural Networks / Cyber Security / Multimedia Technology	3	-	-	20	60	20	-	-	100	3	-	-	3
2308315A 2308315B	PEC	Cloud Computing / Software Modelling and Design	3	-	-	20	60	20	-	-	100	3	-	-	3
2308316A 2308316B	PEC	Cloud Computing Lab / Software Modelling and Design Lab	-	-	2	-	-	-	25	25	50	-	-	1	1
2308317	MD M	Communication Networks	3	-	-	20	60	20			100	3	-	-	3
2308318	OE	Bioinformatics	2	-	-	-	-	50	-	-	50	2	-	-	2
2308319	VSE C	Network and Hardware Support	-	1	2	-	-	-	TU-25	OR-25	50	-	1	1	2
2308320	RM	Project Based Seminar	-	-	2	-	-	-	50	-	50	-	-	1	1
Total			17	01	08	100	300	150	125	75	750	17	1	4	22

SEM-V



T. Y. B. Tech. Pattern 2023 Semester: V - Information Technology 2308301: 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: Discrete Mathematics, Data Structures and Algorithms			
Course Outcomes: On completion of the course, students will be able to			
	Course Outcomes		Bloom's Level
CO1	Design different types of Finite Automata and Machines as Acceptor, Verifier and Translator.		3-Apply
CO2	Understand regular expressions for the regular languages and finite automata.		2-Understand
CO3	Identify types of grammar with simplification of Context Free Grammar.		3-Apply
CO4	Construct a Pushdown Automata machine for the Context Free Language.		3-Apply
CO5	Design different types of Turing Machines as Acceptor, Verifier, Translator and Basic computing machine.		3-Apply
COURSE CONTENTS			
Unit I	Finite Automata	(07 hrs.)	COs Mapped – CO1
Basic Concepts: Symbols, Strings, Language, Formal Language. Finite Automata: FA as Language Acceptor or Verifier. Construction of DFA, NFA (with and without ϵ) Conversion (ϵ -NFA to DFA and NFA to DFA), Applications of FA. Finite State Machines with output: Moore and Mealy Machines. Moore and Mealy M/C Conversion. Limitations of FA.			
Unit II	Regular Expressions and Languages	(07 hrs.)	COs Mapped – CO2
Regular Expressions (RE): Definition and Identities of RE, Operators of RE, Equivalence of two regular expressions, Equivalence of regular expressions and regular languages (RL), Conversion of RE to FA using direct method, Conversion of FA to RE using Arden's theorem, Pumping lemma for RLs, Closure properties of RLs, Applications of Regular Expressions.			
Unit III	Context Free Grammar	(08 hrs.)	COs Mapped – CO3

Context Free Languages: Definition of CFG Leftmost and Rightmost derivations, Ambiguity. Grammar Conversion: LRG to RLG, RLG to LRG Simplification and Normalization (CNF & GNF) and Chomsky Hierarchy (Types 0 to 3). Context Free Language (CFL), Pumping lemma for CFL.			
Unit IV	Pushdown Automata and Post Machine	(08 hrs.)	COs Mapped – CO4
Pushdown Automata (PDA): Introduction and formal definition of PDA, Construction of Transition diagram and Transition table for PDA Deterministic PDA and Nondeterministic PDA, Context Free Language and PDA Conversion of CFG to PDA and PDA to CFG. Power and Limitations of PDA. Post Machine (PM): Definition and construction of Post Machine			
Unit V	Turing Machine and Computational Complexity	(08 hrs.)	COs Mapped – CO5
Turing Machine: Deterministic TM. Variants of TM, Halting problem, Power of TM Multi-tape TM, Universal Turing Machine, Halting problem of TM, Church-Turing thesis, Recursive Languages and Recursively Enumerable Languages, Decidability: Decidable problems concerning regular languages, Un-decidability, Class P, NP, Examples of problems in P and NP.			
Textbooks			
1. J. Martin, Introduction to languages and the Theory of Computation, McGraw Hill. 2. K. Mahesh, Theory of Computation: A Problem-Solving Approach, Wiley. 3. A. Aho, R. Shethi, M. Lam and J. Ulman, Compilers Principles, Techniques and Tools, Pearson.			
Reference Books			
1. J. Hopcroft, R. Motwani and J. Ullman, Introduction to Automata Theory, Languages and Computation, Pearson. 2. D. Cohen, Introduction to Computer Theory, Wiley. 3. V. Kulkarni, Theory of Computation, Oxford University Press. 4. N. Chandrashekhar, K. Mishra, Theory of Computer Science, Automata Languages & Computations, PHI.			

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Two Assignments on Unit-1 & 2, Unit 5	06
2	One Test on Unit-3 & 4	04
3	LMS Test on each Unit	10
	Total	20



T. Y. B. Tech. Pattern 2023 Semester: V - Information Technology 2308302: Operating Systems			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory :03 hrs./week		03	Continuous Comprehensive Evaluation: 20 Marks InSem Exam: 20 Marks EndSem Exam: 60 Marks
Prerequisite Courses: Computer Organization and Architecture, C Programming			
Course Outcomes: On completion of the course, students will be able to–			
	Course Outcomes		Bloom’s Level
CO1	Understand role of operating systems along with basic commands for shell programming.		2-Understand
CO2	Implement concepts of processes, scheduling algorithms and threads.		3-Apply
CO3	Apply concepts of process synchronization, mutual exclusion and deadlock handling.		3-Apply
CO4	Understand various memory management techniques.		2-Understand
CO5	Interpret I/O management and File system in operating system.		2-Understand
COURSE CONTENTS			
Unit I	Overview of Operating System	(07 hrs.)	COs Mapped – CO1
Operating System Objectives and Functions, The Evolution of Operating Systems, Developments Leading to Modern Operating Systems, Virtual Machines, Introduction to Linux OS, BASH Shell scripting: Basic shell commands.			
Unit II	Process Management	(08 hrs.)	COs Mapped – CO2
Process: Concept of a Process, Process States, Process Description, Process Control Threads: Processes and Threads, Concept of Multithreading, Types of Threads, Thread programming Using Pthreads Scheduling: Types of Scheduling, Scheduling Algorithms, First Come First Served, Shortest Job First, Priority, Round Robin			
Unit III	Concurrency Control	(07 hrs.)	COs Mapped – CO3
Process/thread Synchronization and Mutual Exclusion: Principles of Concurrency, Requirements for Mutual Exclusion, Mutual Exclusion: Operating System Support (Semaphores and Mutex) Classical synchronization problems: Readers/Writers Problem, Producer and Consumer problem, Inter-process communication (Pipes, Shared Memory) Deadlock: Principles of Deadlock, Deadlock Modeling, and Strategies to deal with deadlock: Prevention, Avoidance, Detection and Recovery. Example: Dining Philosophers Problem / Banker’s Algorithm			

Unit IV	Memory Management	(07 hrs.)	COs Mapped – CO4
Memory Management: Memory Management Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Buddy System, Relocation, Paging, Page table structure, Segmentation Virtual Memory: Background, Demand Paging, Page Replacement (FIFO, LRU, Optimal), Allocation of frames, Thrashing			
Unit V	Input/Output and File Management	(07 hrs.)	COs Mapped – CO5
I/O Management and Disk Scheduling: I/O Devices, Organization of the I/O Function, I/O Buffering, Disk Scheduling (FIFO, SSTF, SCAN, C-SCAN, LOOK, C-LOOK) File Management: Overview-Files and File Systems, File structure. File Organization and Access, File Directories, File Sharing, Record Blocking, Secondary Storage Management Case Study: Windows, Linux and Android Operating Systems			
Textbooks			
1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014, ISBN-10: 0133805913, ISBN-13: 9780133805918 2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons, Inc., 9th Edition, 2012, ISBN 978-1-118-06333-0			
Reference Books			
1. Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media, ISBN-10: 0596009526, ISBN-13: 978-0596009526 2. Mendel Cooper, Advanced Shell Scripting, Linux Documentation Project 3. Andrew S. Tanenbaum & Herbert Bos, Modern Operating System, Pearson, ISBN-13: 9780133592221, Fourth edition			

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Two Assignments on Unit-1 & 2 and Unit-5	06
2	One Test on Unit 3 and 4	04
3	LMS Test on each Unit	10
	Total	20



T. Y. B. Tech. Pattern 2023 Semester: V - Information Technology 2308303: Machine Learning			
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: Probability and Statistics, Discrete Mathematics			
Course Outcomes: On completion of the course, students will be able to			
	Course Outcomes		Bloom's Level
CO1	Understand basic concepts of machine learning and different types of machine Learning algorithms.		2-Understand
CO2	Understand classification strategies along with their performance measurement parameters.		2-Understand
CO3	Apply various regression techniques along with their performance measurement parameters.		3-Apply
CO4	Apply tree-based and probabilistic machine learning algorithms.		3-Apply
CO5	Apply distance-based models and association rule mining with relevant performance measures.		3-Apply
COURSE CONTENTS			
Unit I	Introduction to Machine Learning	(08 hrs.)	COs Mapped – CO1
Introduction: What is Machine Learning, Definition, Real-life applications, Learning Tasks- Descriptive and Predictive Tasks, Types of Learning: Supervised Learning Unsupervised Learning, Semi-Supervised Learning, Reinforcement Learning. Features: Types of Data (Qualitative and Quantitative), Scales of Measurement (Nominal, Ordinal, Interval, Ratio), Concept of Feature, Feature construction, Feature Selection and Transformation, Curse of Dimensionality, Principal Component Analysis (PCA), Dataset Preparation: Training Vs. Testing Dataset, Dataset Validation Techniques – Hold-out, k-fold Cross validation, Leave-One-Out Cross-Validation (LOOCV)			
Unit II	Classification	(08 hrs.)	COs Mapped – CO2
Binary Classification: Linear Classification model, Performance Evaluation- Confusion Matrix, Accuracy, Precision, Recall, ROC Curves, F-Measure Multi-class Classification: Model, Performance Evaluation Metrics – Per-class Precision and Per-Class Recall, weighted average precision and recall -with example, Handling more than two classes, Multiclass Classification techniques -One vs One, One vs Rest Linear Models: Introduction, Linear Support Vector Machines (SVM) – Introduction, Soft Margin SVM, Introduction to various SVM Kernel to handle non-linear data – RBF, Gaussian, Polynomial, Sigmoid, Overfitting Vs. Underfitting			

Logistic Regression – Model, Cost Function. Mapping			
Unit III	Regression	(07 hrs.)	COs Mapped – CO3
Regression: Introduction, Univariate Regression – Least-Square Method, Model Representation, Cost Functions: MSE, MAE, R-Square, Performance Evaluation, Optimization of Simple Linear Regression with Gradient Descent - Example. Estimating the values of the regression coefficients Multivariate Regression: Model Representation, Regularized Regression: Ridge, Lasso, ElasticNet Introduction to Polynomial Regression: Generalization- Bias Vs. Variance			
Unit IV	Tree based, Probabilistic Models	(07 hrs.)	COs Mapped – CO4
Tree Based Model: Decision Tree – Concepts and Terminologies, Impurity Measures -Gini Index, Information gain, Entropy, Tree Pruning -ID3/C4.5, Advantages and Limitations Probabilistic Models: Conditional Probability and Bayes Theorem, Naïve Bayes Classifier, Bayesian network for Learning and Inferencing, Ensemble Learning Approach: Ensemble Models- Random Forest, XGBoost			
Unit V	Distance based Models	(07 hrs.)	COs Mapped – CO5
Distance Based Models: Distance Metrics (Euclidean, Manhattan, Hamming, Minkowski Distance Metric), Neighbors and Examples, K-Nearest Neighbour for Classification and Regression, Clustering as Learning task: K-means clustering Algorithm-with example, k-medoid algorithm-with example, Hierarchical Clustering, Divisive Dendrogram for hierarchical clustering, Performance Measures Association Rule Mining: Introduction, Rule learning for subgroup discovery, Apriori Algorithm, Performance Measures – Support, Confidence, Lift.			
Textbooks			
1. Ethem Alpaydin, Introduction to Machine Learning, PHI, Second edition, 2013 2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, edition 2012. 3. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, Second edition, 2012 4. Tom M. Mitchell, Machine Learning, 1997, McGraw-Hill, First edition			
Reference Books			
1. C. M. Bishop: Pattern Recognition and Machine Learning, Springer First edition, 2013 2. Ian H Witten, Eibe Frank, Mark A Hall: Data Mining, Practical Machine Learning Tools and Techniques, Elsevier, Third edition 3. Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012 4. Parag Kulkarni: Reinforcement and Systematic Machine Learning for Decision Making, Wiley IEEE Press, Edition July 2012 5. Shalev-Shwartz S., Ben-David S., Understanding Machine Learning: From Theory to Algorithms, CUP, 2014			

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Two Assignments on Unit-1 & 2 and Unit-5	06
2	One Test on Unit 3 and 4	04
3	LMS Test on each Unit	10
	Total	20



T. Y. B. Tech. Pattern 2023 Semester: V - Information Technology 2308304: Operating System Lab		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical :02 hrs./week	01	Term Work: 25 Marks Practical Exam: 25 Marks
Prerequisite Courses: Fundamentals of Data Structures, C Programming		
Course Outcomes: On completion of the course, students will be able to		
	Course Outcomes	Bloom's Level
CO1	Apply the basics of Linux commands to build shell scripts application.	3-Apply
CO2	Implement basic building blocks like processes, threads under the Linux.	3-Apply
CO3	Develop system program for the functioning of concurrency control.	3-Apply
CO4	Develop system programs for Inter Process Communication in Linux.	3-Apply
CO5	Implement various memory management and I/O management algorithms.	3-Apply

COURSE CONTENTS		
Sr. No.	Laboratory Experiments / Assignments	CO Mapped
1	Study of Basic Linux Commands: echo, ls, read, cat, touch, test, loops, arithmetic comparison, conditional loops, grep, sed, etc.	CO1
2	Write a program to implement an address book with options given below: a) Create address book. b) View address book. c) Insert a record. d) Delete a record. e) Modify a record. f) Exit	CO1
3	Implement the C program in which main program accepts the integers to be sorted. Main program uses the FORK system call to create a new process called a child process. Parent process sorts the integers using sorting algorithm and waits for child process using WAIT system call to sort the integers using any sorting algorithm. Also demonstrate zombie and orphan states.	CO2
4	Implement the C program in which main program accepts an array. Main program uses the FORK system call to create a new process called a child process. Parent process sorts an array and passes the sorted array to child process through the command line arguments of EXECVE system call. The child process uses EXECVE system call to load new program which display array in reverse order.	CO2
5	Implement Thread synchronization mechanisms for following classical problems: a) Producer-Consumer problem with counting semaphores and mutex. b) Reader-Writer problem with reader priority ensuring mutual exclusion using mutex	CO3

6	Implement Inter-process Communication using Shared Memory: Application to demonstrate: Client and Server Programs in which server process creates a shared memory segment and write the message to the shared memory segment. Client process reads the message from the shared memory segment and displays it to the screen.	CO4
7	Implement the C program for Page Replacement Algorithms: FCFS, LRU and Optimal for frame size minimum three,	CO5
8	Implement the C program for Disk scheduling Algorithms: SSTF, SCAN, C-LOOK considering initial head position away from spindle.	CO5
Guidelines for Laboratory Conduction		
Use of Open Source Operating System is to be encouraged. All the assignments should be implemented using C programming language on Open-Source OS.		
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, test cases and conclusions). Program codes with sample outputs shall be submitted in soft form.		
Guidelines for Term work Assessment		
1. Each experiment from lab journal is assessed for thirty marks based on three rubrics. 2. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks.		



T. Y. B. Tech. Pattern 2023 Semester: V - Information Technology 2308305: Machine Learning Lab		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical: 02 hrs./week	01	Term work: 25 Marks Practical: 25 Marks
Prerequisite Courses: Python programming		
Course Outcomes: On completion of the course, students will be able to		
	Course Outcomes	Bloom's Level
CO1	Implement basic concepts of machine learning.	3-Apply
CO2	Apply classification strategies along with their performance measurement parameters.	3-Apply
CO3	Apply various regression techniques along with their performance measurement parameters.	3-Apply
CO4	Apply tree-based and probabilistic machine learning algorithms.	3-Apply
CO5	Apply distance-based models and association rule mining with relevant performance measures.	3-Apply

List of Laboratory Experiments / Assignments		
Sr. No.	Laboratory Experiments / Assignments	CO Mapped
1	Download heart dataset from following link. https://www.kaggle.com/zhaoyingzhu/heartcsv Implement following Data Preprocessing using Python / Scilab: a. Data Cleaning b. Handling Missing Data c. Data Transformation, d. Randomly divide dataset in training (75%) and testing (25%).	CO1
2	Consider COVID Dataset Through the diagnosis test I predicted 100 report as COVID positive, but only 45 of those were actually positive. Total 50 people in my sample were actually COVID positive. I have total 500 samples. Create confusion matrix based on above data and find : I. Accuracy II. Precision III. Recall IV. F-1 score.	CO1

3	Assignment on Classification technique: Every year many students give the GRE exam to get admission in foreign Universities. The data set contains GRE Scores (out of 340), TOEFL Scores (out of 120), University Rating (out of 5), Statement of Purpose strength (out of 5), Letter of Recommendation strength (out of 5), Undergraduate GPA (out of 10), Research Experience (0=no, 1=yes), Admitted (0=no, 1=yes). Admitted is the target variable. Data Set :https://www.kaggle.com/mohansacharya/graduate-admissions The counsellor of the firm is supposed check whether the student will get an admission or not based on his/her GRE score and Academic Score. So to help the counsellor to take appropriate decisions build a machine learning model classifier using Decision tree to predict whether a student will get admission or not. Apply Data pre-processing (Label Encoding, Data Transformation....) techniques if necessary. Perform data-preparation (Train-Test Split) Apply Machine Learning Algorithm Evaluate Model.	CO2, CO4
4	Assignment on Personal Loan Modelling Using Logistic Regression: Thera Bank has a large base of deposit customers but very few have taken personal loans. To grow its loan business and increase profits, the bank wants to convert existing depositors into loan customers. A past campaign showed a 9% success rate, encouraging the bank to focus on better-targeted marketing. Build a Logistic Regression model to identify customers likely to accept a personal loan. This will help the bank run efficient campaigns and improve conversion rates. https://www.kaggle.com/datasets/ahmadrafiee/bank-personal-loan	CO2
5	Assignment on Regression technique: Download temperature data from the link below. https://www.kaggle.com/venky73/temperaturesof-india?select=temperatures.csv This data consists of temperatures of INDIA averaging the temperatures of all places month wise. Temperatures values are recorded in CELSIUS - Apply Linear Regression using suitable library function and predict the Month-wise temperature. - Assess the performance of regression models using MSE, MAE and R-Square metrics - Visualize simple regression model.	CO3
6	Assignment on Improving Performance of Classifier Models: A SMS unsolicited mail (every now and then known as cell smartphone junk mail) is any junk message brought to a cellular phone as textual content messaging via the Short Message Service (SMS). Use probabilistic approach (Naive Bayes Classifier / Bayesian Network) to implement SMS Spam Filtering system. SMS messages are categorized as SPAM or HAM using features like length of message, word depend, unique keywords etc. Download Data -Set from: http://archive.ics.uci.edu/ml/datasets/sms+spam+collection This dataset is composed by just one text file, where each line has the correct class followed by the raw message.	CO4

	a. Apply Data pre-processing (Label Encoding, Data Transformation....) techniques if necessary b. Perform data-preparation (Train-Test Split) c. Apply at least two Machine Learning Algorithms and Evaluate Models d. Apply Cross-Validation and Evaluate Models and compare performance. e. Apply Hyper parameter tuning and evaluate models and compare performance.	
7	Assignment on Clustering Techniques: Download the following customer dataset from below link: Data Set: https://www.kaggle.com/shwetabh123/mall-customers This dataset gives the data of Income and money spent by the customers visiting a shopping mall. The data set contains Customer ID, Gender, Age, Annual Income, Spending Score. Therefore, as a mall owner you need to find the group of people who are the profitable customers for the mall owner. Apply at least two clustering algorithms (based on Spending Score) to find the group of customers. a. Apply Data pre-processing (Label Encoding, Data Transformation) techniques if necessary. b. Perform data-preparation (Train-Test Split)	CO4
8	Assignment on Association Rule Learning: Download Market Basket Optimization dataset from below link. Data Set: https://www.kaggle.com/hemanthkumar05/market-basket-optimization This dataset comprises the list of transactions of a retail company over the period of one week. It contains a total of 7501 transaction records where each record consists of the list of items sold in one transaction. Using this record of transactions and items in each transaction, find the association rules between items. There is no header in the dataset and the first row contains the first transaction, so mentioned header = None here while loading dataset. Follow the following steps: Data Preprocessing Generate the list of transactions from the dataset Train Apriori algorithm on the dataset Visualize the list of rules Generated rules depend on the values of hyper parameters. By increasing the minimum confidence value and find the rules accordingly	CO5
Reference Books		
1. Ethem Alpaydin, Introduction to Machine Learning, PHI Second edition, 2013 2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, edition 2012 3. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, Second edition, 2012 4. Tom M. Mitchell , Machine Learning, 1997, McGraw-Hill, First edition 5. C. M. Bishop: Pattern Recognition and Machine Learning, Springer, First edition-2013 6. Ian H Witten, Eibe Frank, Mark A Hall: Data Mining, Practical Machine Learning Tools and Techniques, Elsevier, Third edition 7. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, Second edition, 2012 8. Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012. 9. Shalev-Shwartz S., Ben-David S., Understanding Machine Learning: From Theory to Algorithms,		

CUP, 2014
10. Jack Zurada: Introduction to Artificial Neural Systems, PWS Publishing Co. Boston, 2002
• Use of Open-source software is to be encouraged. • All the assignments should be implemented using Python programming language
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, test cases and conclusions). Program codes with sample outputs shall be submitted in soft form.
Guidelines for Term work Assessment
1. Each experiment from lab journal is assessed for thirty marks based on three rubrics. 2. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks.



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

T. Y. B. Tech. Pattern 2023 Semester: V - Information Technology 2308306A: Internet of Things			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory :03 hrs/week		03	Continuous Comprehensive Evaluation: 20Marks InSem Exam: 20Marks EndSem Exam: 60Marks
Prerequisite Courses: Computer Organization and Architecture			
Course Outcomes: On completion of the course, students will be able to			
	Course Outcomes		Bloom’s Level
CO1	Understand fundamental requirements and architecture of IoT		2- Understand
CO2	Understand business models for the Internet of Things		2- Understand
CO3	Explore the various platforms in IoT.		2- Understand
CO4	Explore IoT application based on network architecture.		2- Understand
CO5	Explore smart object interface using wireless technology for IoT application		2- Understand
COURSE CONTENTS			
Unit I	Introduction to Internet of Things	(08 hrs.)	COs Mapped - CO1
What is the Internet of Things?: History of IoT, About IoT, Overview and Motivations, Examples of Applications of IoT, Internet of Things Definitions and Frameworks: IoT Definitions, IoT Architecture, General Observations, ITU-T Views, IoT Framework. Physical Design of IoT: IoT Protocols, Logical Design of IoT: Functional block. IoT Enabling Technologies: WSN, Cloud Computing, Big data Analytics, Communication Protocols, Embedded systems IoT levels and Deployment templates: Level 1 to Level 5.			
Unit II	Fundamental of IoT Network Architecture and Design	(08 hrs.)	COs Mapped – CO4
The one M2M IoT Standardized Architecture, The IoT World Forum (IoTWF) Standardized Architecture, A Simplified IoT Architecture, IoT protocol stack, The Core IoT Functional Stack, IoT Data Management and Compute Stack: Fog Computing, Edge Computing, The Hierarchy of Edge, FogCloudIoT and M2M: Introduction to M2M, Difference between IoT and M2M			
Unit III	Smart Objects: the “Things” in IoT	(07 hrs.)	COs Mapped – CO5
Sensors, Actuators, and Smart Objects, Sensor Networks, Mitigation Strategies for securing IoT Devices. Connecting Smart Objects: Communications Criteria Introduction to Non-IP Based Protocol (IEEE 802.11, IEEE 802.15.4), BlueTooth, ZigBee, IP Based Protocol (IPV4, IPV6, 6LoWPAN)			

Unit IV	Addressing Techniques and Business models for IoT	(06 hrs.)	COs Mapped – CO2
Address Capabilities, IPv6 Protocol Overview, IPv6 Tunnelling, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6. Business Models and Business Model Innovation, Value Creation in the Internet of Things, Business Model Scenarios for the Internet of Things.			
Unit V	IoT platforms and its applications	(09 hrs.)	COs Mapped – CO3
What is an IoT Device, Exemplary Devices: Raspberry Pi, Raspberry Pi Interfaces Other IoT Devices: CubieBoard, ARDUINO Internet of Things Applications and their security challenges: Smart Metering Advanced Metering Infrastructure, e-Health Body Area Networks, City Automation, Home Automation			
Textbooks			
1. Vijay Madiseti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”, 2014, Universities Press (India) Pvt. Ltd., ISBN: 9788173719547 2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, Cisco Press			
Reference Books			
1. Peter Waher, “Learning Internet of Things”, 2015, Packt Publishing, ISBN: 978-1-78355-353-2 2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", 2010, Wiley Publication, ISBN: 978-0-470-99765-9 3. Simon Monk, “Raspberry Pi Cookbook, Software and Hardware Problems and solutions”, 2019, O'Reilly, ISBN 9781492043225			

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Two Assignments on Unit-1 & 2 and Unit-5	06
2	One Test on Unit 3 and 4	04
3	LMS Test on each Unit	10
	Total	20



T. Y. B. Tech. Pattern 2023 Semester: V - Information Technology 2308306B: Design and Analysis of Algorithms			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory :03 hrs./week		03	Continuous Comprehensive Evaluation: 20 Marks InSem Exam: 20 Marks EndSem Exam: 60 Marks
Prerequisite Courses: Data Structures and Algorithms, Discrete Mathematics			
Course Outcomes: On completion of the course, students will be able to			
	Course Outcomes		Bloom's Level
CO1	Calculate computational complexity using asymptotic notations for various algorithms.		3-Apply
CO2	Apply Divide-and-Conquer and Greedy approach to design algorithms.		3-Apply
CO3	Understand optimization problems using dynamic programming.		2-Understand
CO4	Illustrate different problems using Backtracking.		3-Apply
CO5	Explore different methods of Branch and Bound strategy.		2-Understand
COURSE CONTENTS			
Unit I	Introduction	(08 hrs.)	COs Mapped- CO1
Proof Techniques: Contradiction, Mathematical Induction, Direct proofs, Proof by counter example, Proof by contraposition. Analysis of Algorithm: Efficiency- Analysis framework, asymptotic notations – big O, theta and omega. Analysis of Non-recursive and recursive algorithms: Solving Recurrence Equations using Masters theorem and Substitution method. Brute Force method: Introduction to Brute Force method & Exhaustive search, Brute Force solution to 8 queens' problem.			
Unit II	Divide and Conquer and Greedy Method	(08 hrs.)	COs Mapped - CO1, CO2
Divide & Conquer: General method, Quick Sort – Worst, Best and average case. Binary search, Finding MaxMin, Large integer Multiplication (for all above algorithms analysis to be done with recurrence). Greedy Method: General method and characteristics, Kruskal's method for MST (using $n \log n$ complexity), Dijkstra's Algorithm, Fractional Knapsack problem, Job Sequencing, Max flow problem and Ford-Fulkerson algorithm in transport network.			
Unit III	Dynamic Programming	(08 hrs.)	COs Mapped - CO1, CO3
General strategy, Principle of optimality, 0/1 knapsack Problem, Coin change-making problem, Bellman Ford Algorithm, Multistage Graph problem (using Forward computation), Travelling Salesman Problem			
Unit IV	Backtracking	(07 hrs.)	COs Mapped - CO1, CO4
General method, Recursive backtracking algorithm, Iterative backtracking method. n-Queen problem, Sum of subsets, Graph coloring, 0/1 Knapsack Problem.			
Unit V	Branch and Bound	(07 hrs.)	COs Mapped -

			CO1, CO5
The method, Control abstractions for Least Cost Search, Bounding, FIFO branch and bound, LC branch and bound, 0/1 Knapsack problem – LC branch and bound and FIFO branch and bound solution, Travelling salesperson problem- LC branch and bound			
Textbooks			
1. Horowitz and Sahani, Fundamentals of computer Algorithms, Galgotia, ISBN 81-7371-612-9. 2. Anany Levitin, Introduction to the Design & Analysis of Algorithm, Pearson, ISBN 81- 7758-835-4			
Reference Books			
1. Jon Kleinberg, Algorithm Design, Pearson, ISBN: 0-321-29535-8. 2. S. Sridhar, Design and Analysis of Algorithms, Oxford, ISBN 10 : 0-19-809369-1. 3. Thomas H Cormen and Charles E.L Leiserson, Introduction to Algorithm, PHI, ISBN: 9788120340077			

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Two Assignments on Unit-1 & 2, Unit 5	06
2	One Test on Unit-3 & 4	04
3	LMS Test on each Unit	10
	Total	20



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

T. Y. B. Tech. Pattern 2023 Semester: V - Information Technology 2308307A: Internet of Things Lab		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical: 02 hrs./week	01	Term work: 25 Marks Practical: 25 Marks
Prerequisite Courses: Computer Organization and Architecture		
Course Outcomes: On completion of the course, students will be able to		
	Course Outcomes	Bloom's Level
CO1	Understand fundamental requirements and architecture of IoT	2- Understand
CO2	Understand business models for the Internet of Things	2- Understand
CO3	Explore the various platforms in IoT.	2- Understand
CO4	Implement IoT application based on network architecture	3-Apply
CO5	Implement smart object interface using wireless technology for IoT application	3-Apply

List of Laboratory Experiments / Assignments		
Sr. No.	Laboratory Experiments / Assignments	COs Mapped
1	Study of different operating systems for Raspberry Pi. Understanding the process of OS installation on Raspberry – Pi	CO1, CO3 CO5
2	Study of Connectivity and Configuration of Raspberry-Pi circuit with basic peripherals. Understanding GPIO and its use in program. Write an application to interface LEDs with Raspberry-Pi and blink LED.	CO1, CO3 CO5
3	Understanding the connectivity of Raspberry-Pi / Arduino with IR sensor. Write an application to detect obstacle and notify user using LEDs.	CO1, CO3, CO5
4	Understanding the connectivity of Raspberry-Pi / Arduino with ultrasonic sensor. Calculate the distance to an object with the help of an ultrasonic sensor.	CO1, CO3, CO5
5	Design and implement IoT system using Arduino Uno/ Raspberry Pi using 'Ultrasonic sensor and Servo motor' such as 'Door opener in home automation'.	CO1, CO3, CO5
6	Design and implement parameter monitoring IoT system keeping records on Cloud such as 'environment humidity and temperature monitoring'.	CO1, CO3, CO5
7	Design and implement real time monitoring system using android phone (Blynk App.)	CO1, CO3, CO5
8	Understanding and connectivity of Raspberry-Pi /Beagle board with camera. Write an application to capture and store the image.	CO1, CO3, CO5
9	Mini Project based on Smart IoT Application (e.g., healthcare, agriculture, home automation).	CO1, CO2, CO3, CO4, CO5

10	Study of Scienteck IoT Builder kit e.g. Agriculture automation	CO1, CO2, CO3, CO4, CO5
Guidelines for Laboratory Conduction		
1. Teacher will brief the experiment given to students its procedure 2. Apparatus and equipment required for the allotted experiment will be provided by the lab assistants using SOP 3. Students will perform the allotted experiment in a group (three/four students in each group) under the supervision of faculty and lab assistant 4. After performing the experiment students will check their output from the teacher		
Guidelines for Student's Lab Journal		
Write-up should include title, aim, steps of assignment.		
Guidelines for Term work Assessment		
1. Each experiment from lab journal is assessed for thirty marks based on three rubrics. 2. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks.		



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

T. Y. B. Tech. Pattern 2023 Semester: V - Information Technology 2308307B: Design and Analysis of Algorithms Lab		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical: 02 hrs./week	01	Term work: 25 Marks Practical: 25 Marks
Prerequisite Courses: Data Structures and Algorithms, Discrete Mathematics		
Course Outcomes: On completion of the course, students will be able to–		
	Course Outcomes	Bloom's Level
CO1	Calculate computational complexity using asymptotic notations for various algorithms.	3-Apply
CO2	Apply Divide-and-Conquer and Greedy approach to design algorithms.	3-Apply
CO3	Implement optimization problems using dynamic programming.	3-Apply
CO4	Implement algorithmic solution using backtracking strategy.	3-Apply
CO5	Implement algorithmic solution using Branch and Bound strategy.	3-Apply
List of Laboratory Experiments / Assignments		
Sr. No.	Laboratory Experiments / Assignments	COs Mapped
1	Write a program to implement Binary Search using Divide and Conquer approach.	CO2
2	Write a program to implement Quick sort & Merge sort using Divide and Conquer approach.	CO2
3	Implementing Insertion Sort in an E-commerce Website: • Problem Statement: Develop a function to sort a list of products based on their prices using the Insertion Sort algorithm. The function should be capable of integrating into an e-commerce system to demonstrate the sorting process. • Requirements: Create a list of products with attributes such as ProductID, Name, Price. • Implement a function to perform Insertion Sort on the list of products based on their prices. • The function should return the sorted list of products. • Ensure the system handles edge cases, such as empty product lists or duplicate prices.	CO1
4	Write a program to find Maximum and Minimum element in an array using Divide and Conquer strategy and verify the time complexity.	CO1, CO2
5	Write a program to implement Knapsack problem using Greedy approach.	CO2
6	Write a program to implement Prim's algorithm using Greedy approach.	CO2

7	Write a program to implement Kruskal's algorithm using Greedy approach.	CO2
8	Write a program to solve the travelling salesman problem and to print the path and the cost using Dynamic Programming.	CO1, CO3
9	Write a recursive program to find the solution of placing n queens on chessboard so that no two queens attack each other using Backtracking.	CO4
10	Write a program to solve the travelling salesman problem and to print the path and the cost using Branch and Bound.	CO1, CO5
Guidelines for Laboratory Conduction		
• Use of Open-source software is to be encouraged. • All the assignments should be implemented using C/C++/Java/Python programming language.		
Guidelines for Student's Lab Journal		
1. The laboratory assignments are to be submitted by students in the form of a journal. 2. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, problem statement, theory Concepts in brief, algorithm, 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).		



K. K. Wagh Institute of Engineering Education and Research, Nashik
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T. Y. B. Tech. Pattern 2023 Semester: V - Information Technology 2308308: IPR and Patents			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory: 02 hrs./week		02	Continuous Comprehensive Evaluation: 50 Marks
Prerequisite Courses: -			
Course Outcomes: On completion of the course, students will be able to			
	Course Outcomes		Bloom’s Level
CO1	Understand the concepts of Intellectual Property Rights.		2-Understand
CO2	Understand the Law of Trademark.		2-Understand
CO3	Understand the Law of Copyrights.		2-Understand
CO4	Understand the Law of Patents		2-Understand
CO5	Understand the knowledge how to protect trade secrets.		2-Understand
COURSE CONTENTS			
Unit I	Introduction to Intellectual Property Law	(06 hrs.)	COs Mapped – CO1
The Evolutionary Past - The IPR Tool Kit- Para -Legal Tasks in Intellectual Property Law – Ethical obligations in Para Legal Tasks in Intellectual Property Law. Introduction to Cyber Law – Innovations and Inventions Trade related Intellectual Property Right			
Unit II	Law of Trademark	(06 hrs.)	COs Mapped – CO2
Trademark Registration Process – Post registration Procedures – Trademark maintenance - Transfer of Rights - Inter partes Proceeding – Infringement - Dilution Ownership of Trade mark – Likelihood of confusion - Trademarks claims – Trademarks Litigations – International Trademark Laws.			
Unit III	Law of Copyright	(06 hrs.)	COs Mapped – CO3
Principles of Copyright Principles -The Subjects Matter of Copy right – The Rights Afforded by Copyright Law – Copy right Ownership, Transfer, and duration – Right to prepare Derivative works – Rights of Distribution – Rights of Perform the work Publicity Copyright Formalities and Registrations - Limitations - Copyright disputes and International Copyright Law – Semiconductor Chip Protection Act			
Unit IV	Law of patents	(06 hrs.)	COs Mapped – CO4

Foundation of Patent Law, patents searches, applications and Post-Issuance Proceedings, Patent Ownership and Transfer, Patent Infringement, International Patent Law			
Unit V	Introduction to Trade Secret	(06 hrs.)	COs Mapped – CO4
Maintaining Trade Secret – Physical Security – Employee Limitation - Employee confidentiality agreement - Trade Secret Law - Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law			
Text Books			
1. Deborah E. Bouchoux: “Intellectual Property”. Cengage learning, New Delhi 2. M. Ashok Kumar and Mohd. Iqbal Ali: “Intellectual Property Right” Serials Pub 3. Cyber Law. Texts & Cases, South-Western’s Special Topics Collections 4. Prabhuddha Ganguli: ‘Intellectual Property Rights’ Tata Mc-Graw –Hill, New Delhi 5. https://nptel.ac.in/courses/109105112			

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	One Assignment on each Unit (4*5)	20
2	One MCQ Test on each Unit (4*5)	20
3	One Case Study/Presentation	10
	Total	50



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

T. Y. B. Tech. Pattern 2023 Semester: V - Information Technology 2308309: Data Communication			
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: Fundamentals of Electronics Engineering			
Course Outcomes: On completion of the course, students will be able to			
	Course Outcomes		Bloom's Level
CO1	Understand basics of information and communication theory.		2-Understand
CO2	Understand different line coding techniques.		2-Understand
CO3	Understand the basics of cryptography in communication.		2-Understand
CO4	Use different error detection and correction codes in digital Communication.		3-Apply
CO5	Analyse the quality of digital communication in the presence of noise.		4-Analyse
COURSE CONTENTS			
Unit I	Basics of Information Theory	(07 hrs.)	COs Mapped – CO1, CO5
Introduction to Information Theory, Uncertainty and Information, Average Mutual Information and Entropy, Source Coding Theorem, Huffman Coding, Shannon Fano Elias Coding, Arithmetic Coding Fundamental theorem of Information Theory, Channel Models, Channel Capacity and Channel Coding.			
Unit II	Basics of Communication Theory	(07 hrs.)	COs Mapped – CO1, CO5
Basics of data communication, Types of Signals, , Transmission Impairments, Data Rate Limits, Bandwidth Utilization and Data Rate Limits, Nyquist and Shannon Theorem, Performance – Bandwidth and Throughput.			
Unit III	Digital Transmission	(08 hrs.)	COs Mapped – CO2
Digital to Digital Conversion - Signal element Vs Data Element, Signal rate Vs Data Rate, Line Coding Schemes – Unipolar, Polar, Bipolar: Manchester & Differential Manchester, AMI Analog to Digital Conversion - Pulse code modulation (PCM), Nyquist Sampling Theorem, Delta modulation, Digital modulation techniques			
Unit IV	Error Detection and Correction	(08 hrs.)	COs Mapped – CO4
Types of Errors, Redundancy, Detection Versus Correction, Coding Block Coding: Error Detection, Hamming Distance, Minimum Hamming Distance Linear Block Codes for Error Correction: Basic Definition, Linear Block Codes, Parity Check Code			

Cyclic Code: Cyclic Redundancy Check (CRC) codes, Encoder and Decoder, Polynomial, CRC code encoder using Polynomial, Cyclic Code Analysis Case Study: Enhancing Vehicle Communication and Safety Using CAN/FlexRay Protocol, Implementation of CAN/FlexRay Protocol in Automotive Systems			
Unit V	Introduction to Cryptography	(06 hrs.)	COs Mapped – CO3
Definition, Plain text, Cipher text, Key – Symmetric & Asymmetric Key Cryptography, Traditional Ciphers- Substitution & Transposition, RSA Algorithm. Case Study: Securing Online Transactions Using Cryptography – A Real-Time Example of PayTM			
Textbooks			
1. Behrouz A. Forouzan, “Data Communication and Networking”, McGraw Hill, 2012, Fifth edition, ISBN: 978-0073376226 2. Ranjan Bose, “Information Theory Coding and Cryptography”, McGraw Hill, 2017, Third edition, ISBN: 978-9385880568			
Reference Books			
1. J. A. Thomas and T. M. Cover, “Elements of Information theory”, John Wiley, 2006, Second edition, ISBN: 978-0471241959 2. K. Sam Shanmugam, “Digital and Analog communication systems”, John Wiley 2006, ISBN: 978-8126509140			

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Two Assignments on Unit-1 & 2 and Unit-5	06
2	One Test on Unit 3 and 4	04
3	LMS Test on each Unit	10
	Total	20



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

TY B. Tech. Pattern 2023 Semester: VI -Information Technology 2308310: Project Based Learning		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Tutorial: 01 hr./week Practical: 02 hrs./week	01 01	Term work: 25 Marks Tutorial: 25 Marks
Prerequisite Courses:		
Course Outcomes: On completion of the course, students will be able to		
	Course Outcomes	Bloom's Level
CO1	Design solution to real life problems and analyse its concerns through shared cognition.	3-Apply
CO2	Apply learning by doing 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		
Group Structure		
Group structure should enable students to work in mentor-monitored groups. The students plan, manage and complete a task/project / activity which address the stated problem.		
1. There should be a team of 3 to 6 students who will work cohesively.		
2. A Mentor should be assigned to individual groups who will help them with learning and development processes.		
Selection of Project/Problem		
1. The project scope/topic can be from any field/area, but selection related to IT technical aspect is desirable.		
2. The project/problem done in first year engineering could be extended further, based on its potential and significance analysis.		
3. Project/problem requiring solutions through conceptual model development and use of software tools should be preferred.		
4. Different alternate approaches such as theoretical, practical, working model, demonstration or software analysis should be used in solving/implementing of project/problem.		
5. The project/problem requiring a multi-disciplinary approach to solve it should be preferred.		
6. Problem may require in-depth study of specific practical, scientific or technical domain.		
7. Hands-on activities, organizational and field visits, interacting with research institutes and expert consultation should be included in the approach to making students aware of the latest technologies.		
Assessment		
The department should be committed to assessing and evaluating both student performance and solution impact. Progress of PBL will be monitored regularly on a weekly basis. Weekly review of the work is necessary. During the process of monitoring and continuous assessment and evaluation the individual and team performance is to be measured by mentor. Students must maintain an institutional		

culture of authentic collaboration, self- motivation, peer learning and personal responsiveness. The institution/department should support students in this regard through guidance/orientation programs and the provision of appropriate resources and services. Supervisor/mentor and students must actively participate in assessment and evaluation processes. The group may demonstrate their knowledge and skills by developing a public product and/or report and/or presentation.

1. Individual assessment for each student (Understanding individual capacity, role and involvement in the project).
2. Group assessment (roles defined, distribution of work, intra-team communication and togetherness.
3. Documentation and presentation.

Evaluation and Continuous Assessment

It is recommended that all activities are recorded in PBL workbook, regular assessment of work to be done and proper documents are to be maintained at college end by both students as well as mentor. The PBL workbook will reflect accountability, punctuality, technical writing ability and workflow of the task undertaken. Continuous Assessment Sheet (CAS) is to be maintained by all mentors/department. Recommended parameters for assessment, evaluation and weightage:

1. Idea Inception (5%)
2. Outcomes of PBL/Problem Solving Skills/Solution provided/Final product (40%) (Individual assessment and team assessment)
3. Documentation (Gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents (25%)
4. Potential for the patent (10%)
5. Demonstration (Presentation, User Interface, Usability etc.) (10%)
6. Contest Participation/ publication (5%)
7. Awareness/Consideration of Environment/ Social /Ethics/ Safety measures/Legal aspects (5%).

Design the rubrics based on the above parameters for evaluation of student performance

Faculty/Mentor is expected to perform following activities

Revision of PBL concepts Skill assessment of students Formation of diversified and balanced groups Share information about patent, copyright and publications to make students aware about it Discussion of sample case studies Design of the rubrics for evaluation of student performance Discussion of the rubrics with students Weekly Assessment of the deliverables such as Presentation, Report, Concept map, logbook Scaffolding of the students Summative and Formative assessment

Reference Books

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

SEM-VI

T.Y. B. Tech w.e.f. AY 2025-26															
SEM-VI															
Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSE M	ENDSE M	CCE	TU /TW	PR /OR	TOTAL	TH	TU	PR	TOTAL
2308311	PCC	Software Engineering and Project Management	3	-	-	20	60	20	-	-	100	3	-	-	3
2308312	PCC	Data Science and Big Data Analytics	3	-	-	20	60	20	-	-	100	3	-	-	3
2308313	PCC	Data Science and Big Data Analytics Lab	-	-	2	-	-	-	25	25	50	-	-	1	1
2308314A 2308314B 2308314C	PEC	Artificial Intelligence and Neural Networks / Cyber Security / Multimedia Technology	3	-	-	20	60	20	-	-	100	3	-	-	3
2308315A 2308315B	PEC	Cloud Computing / Software Modelling and Design	3	-	-	20	60	20	-	-	100	3	-	-	3
2308316A 2308316B	PEC	Cloud Computing Lab / Software Modelling and Design Lab	-	-	2	-	-	-	25	25	50	-	-	1	1
2308317	MD M	Communication Networks	3	-	-	20	60	20			100	3	-	-	3
2308318	OE	Bioinformatics	2	-	-	-	-	50	-	-	50	2	-	-	2
2308319	VSE C	Network and Hardware Support	-	1	2	-	-	-	TU-25	OR-25	50	-	1	1	2
2308320	RM	Project Based Seminar	-	-	2	-	-	-	50	-	50	-	-	1	1
Total			17	01	08	100	300	150	125	75	750	17	1	4	22



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

T. Y. B. Tech. Pattern 2023 Semester: VI - Information Technology 2308311: Software Engineering and Project Management			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory: 03 hrs./week		03	Continuous Comprehensive Evaluation: 20 Marks InSem Exam: 20 Marks EndSem Exam: 60 Marks
Prerequisite Courses:			
Course Outcomes: On completion of the course, students will be able to			
	Course Outcomes		Bloom's Level
CO1	Understand basics of Software Engineering and process models.		2-Understand
CO2	Understand requirement analysis, model systems and standard engineering techniques.		2-Understand
CO3	Discuss the SCRUM process and agile process models.		2-Understand
CO4	Understand IT project management through the life cycle of the project and quality standards.		2-Understand
CO5	Explore CASE tools and recent trends in software engineering.		2-Understand
COURSE CONTENTS			
Unit I	Introduction to Software Engineering	(08 hrs.)	CO1
Software, Software Process: Software Engineering Practice, Software Myths, Generic Process model, Software Development Life Cycle (SDLC). Analysis and comparison of Process Models: Waterfall Model, Incremental Models, Evolutionary Models, Concurrent, Specialized Process Models, Personal and Team Process Models, Introduction to Clean Room.			
Unit II	Requirement Analysis and Project Planning	(07 hrs.)	CO2
Requirements Capturing Analysis: Requirements engineering (elicitation, specification, validation, negotiation, prioritizing requirements (Kano diagram) - real life application case study. UML models: use case diagram and class diagram, data modelling, data and control flow model, behavioural modelling using state diagrams - real life application case study, software Requirement Specification. Project Planning: Planning Scope Management, Creating the Work Breakdown Structure, Effort estimation and scheduling: Importance of Project Schedules, Estimating Activity Resources, Estimating Activity Durations, Developing the Schedule using Gantt Charts Program Evaluation and Review Technique (PERT) with examples.			

Unit III	Agile Development Process	(07 hrs.)	CO3
Agile Development: Agile manifesto, agility and cost of change, agility principles, myth of planned development, toolset for the agile process. Agile Practices: Test driven development, refactoring, pair programming, continuous integration, exploratory testing versus scripted testing Extreme Programming: XP values, process, industrial XP, SCRUM - process flow, scrum roles, scrum cycle description, product backlog, sprint planning meeting, sprint backlog, sprint execution, daily scrum meeting, maintaining sprint backlog and burn-down chart, sprint review and retrospective.			
Unit IV	Project Management	(07 hrs.)	CO4
Project monitoring and control: Tools for project management, Software tools like Microsoft project management or any other open source tools. The Importance of Project Quality Management: Planning Quality Management, Performing Quality Assurance, Controlling Quality, IT Risk Management. Software Engineering. Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, CMM Models.			
Unit V	Recent Trends in Software Engineering and Project Management	(07 hrs.)	CO5
Software configuration management: SCM basics, SCM repository, SCM process, SCM tools such as GitHub, CASE – taxonomy, tool-kits, workbenches, environments, components of CASE, categories (upper, lower and integrated CASE tools). Emerging software engineering trends: Technology evolution, process trends, collaborative development, test-driven development, global software development challenges. Project Management trends: CRM, ERP: Basic concepts, Advantages and limitations, SAP, Business process reengineering, International Project Management, Case studies.			
Textbooks			
1. Roger Pressman, “Software Engineering: A Practitioner’s Approach”, McGraw Hill, ISBN: 0-07-3375 2. Ian Sommerville, ”Software Engineering”, Addison and Wesley, ISBN 0-13-703515-2			
Reference Books			
1. PankajJalote, Software Engineering: A Precise Approach, Wiley India, ISBN: 9788126523115 2. Marchewka, Information Technology Project Management, Wiley India, ISBN: 9788126543946. 3. Chris Dawson with Ben Straub, Building Tools with GitHub, O’Reilly, Shroff publishers, ISBN: 978-93- 5213-333-8			

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Two Assignments on Unit-1 & 2, Unit 5	06
2	One Test on Unit-3 & 4	04
3	LMS Test on each Unit	10
	Total	20



T. Y. B. Tech. Pattern 2023 Semester: VI - Information Technology 2308312: Data Science and Big Data 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: Discrete Mathematics, Database Management Systems			
Course Outcomes: On completion of the course, students will be able to			
	Course Outcomes		Bloom’s Level
CO1	Understand Big data primitives and fundamentals for application development.		2-Understand
CO2	Apply various mathematical models for Big Data.		3-Apply
CO3	Explore Big Data learning skills by developing applications using programming platforms like Hadoop.		2-Understand
CO4	Analyse Big data applications using tools like Hive and Python.		4-Analyse
CO5	Understand the needs, challenges and techniques for big data visualization for data analysis.		2-Understand
COURSE CONTENTS			
Unit I	Introduction: Data Science and Big Data	(07 hrs.)	COs Mapped – CO1
Introduction to Subject & Big Data, Applications, Defining Data science and Big Data, Big Data examples, Data Explosion: Data Volume, Data Variety, Data Velocity and Veracity, Big data infrastructure and challenges, Big Data Processing Architectures: Data Warehouse, Re-Engineering the Data Warehouse, shared everything and shared nothing architecture, Big data learning approaches, Data Science – The Big Picture: Relation between AI, Statistical Learning, Machine Learning, Data Mining and Big Data Analytics.			
Unit II	Mathematical Foundation of Big Data	(08 hrs.)	COs Mapped – CO2
Probability: Random Variables and Joint Probability, Conditional Probability, Concept of Markov chains, Tail bounds, Markov chains, Random walks, Pair-wise independence and universal hashing Approximate counting, Approximate median. Data Streaming Models and Statistical Methods: Flajolet Martin algorithm, Distance Sampling and Random Projections, Bloom filters, Mode, Variance, standard deviation, Correlation analysis and Analysis of Variance.			
Unit III	Big data Processing	(08 hrs.)	COs Mapped – CO3
Big Data Processing:- Batch Processing vs Real Time Processing, Ecosystem and Technologies, Introduction to Google file system, Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read, NameNode, Secondary NameNode, and			

DataNode, Hadoop MapReduce paradigm, Map Reduce tasks, Job, Task trackers, Cluster Setup – SSH & Hadoop Configuration, Introduction to NOSQL, Textual ETL processing.			
Unit IV	Big Data analytics	(07 hrs.)	COs Mapped – CO4
Big Data Analytics- Architecture and Life Cycle, Types of analysis, Analytical approaches, Data Analytics with Mathematical manipulations, Data Ingestion from different sources, Data cleaning, Handling missing values, data imputation, Data transformation, Data Standardization, Handling categorical data with 2 and more categories, statistical and graphical analysis methods, Hive Data Analytics, Apache Spark: Introduction, Architecture, Spark SQL			
Unit V	Big Data Visualization	(06 hrs.)	COs Mapped – CO5
Introduction to Data visualization, Challenges to Big data visualization, Conventional data visualization tools, Techniques for visual data representations, Types of data visualization, Visualizing Big Data, Tools used in data visualization, Propriety Data Visualization tools, Open –source data visualization tools, Case Study: Analysis of a business problem of Zomato using visualization, Analytical techniques used in Big data visualization, Data Visualization using Tableau Introduction to: Candela, D3.js, Google Chart API.			
Textbooks			
1. Krish Krishnan, Data warehousing in the age of Big Data, Elsevier, ISBN: 9780124058910, First edition. 2. DT Editorial Services, Big Data, Black Book, DT Editorial Services, ISBN: 9789351197577, 2016 edition.			
Reference Books			
1. Mitzenmacher and Upfal, Probability and Computing: Randomized Algorithms and Probabilistic Analysis, Cambridge University press, ISBN :521835402 hardback. 2. EMC Education Services, Data Science and Big Data Analytics, Wiley India, ISBN:9788126556533			

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Two Assignments on Unit-1& 2 and Unit-5	06
2	One Test on Unit 3 and 4	04
3	LMS Test on each Unit	10
	Total	20



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

T. Y. B. Tech. Pattern 2023 Semester: VI - Information Technology 2308313: Data Science and Big Data Analytics Lab		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical :02 hrs./week	01	Term work: 25 Marks Practical: 25 Marks
Course Outcomes: On completion of the course, students will be able to		
	Course Outcomes	Bloom's Level
CO1	Apply big data primitives and fundamentals for application development.	3-Apply
CO2	Apply the Analytical concept of big data using Python.	3-Apply
CO3	Visualize the big data using Tableau.	3-Apply
CO4	Design algorithms and techniques for big data analytics.	3-Apply
CO5	Develop big data analytic application for emerging trends.	3-Apply
List of Laboratory Experiments / Assignments		
<u>Group A: Assignments based on the Hadoop</u>		
1. Single node/Multiple node Hadoop Installation - CO1 2. Design a distributed application using MapReduce (Using Java) which processes a log file of a system. List out the users who have logged for maximum period on the system. Use simple log file from the Internet and process it using a pseudo distribution mode on Hadoop platform. – CO1 3. Write an application using HiveQL for flight information system which will include –CO4 a. Creating an external Hive table. b. Load table with data, insert new values and field in the table, Join tables with Hive c. Create index on Flight Information Table d. Find the average departure delay per day in 2008.		
<u>Group B: Assignments based on Data Analytics using Python</u>		
1. Perform the following operations using Python on the Facebook metrics data sets – CO2 a. Create data subsets b. Merge Data c. Sort Data d. Transposing Data e. Shape and reshape Data 2. Perform the following operations using Python on the Air quality and Heart Disease data sets- CO2 a. Data cleaning b. Data integration c. Data transformation d. Error correcting e. Data model building 3. Visualize the data using Python libraries matplotlib, seaborn by plotting the graphs for Air quality and Heart disease datasets – CO4		

4. Perform the following data visualization operations using Tableau on Adult and Iris datasets. – **CO3**
 - a. 1D (Linear) Data visualization
 - b. 2D (Planar) Data Visualization
 - c. 3D (Volumetric) Data Visualization
 - d. Temporal Data Visualization
 - e. Multidimensional Data Visualization
 - f. Tree/ Hierarchical Data visualization
 - g. Network Data visualization
5. Perform the following operations for Iris and Air quality datasets using **Spark SQL and DataFrames** – **CO4**
 - a. Loading
 - b. Cleaning
 - c. Exploratory analysis

Group C: Model Implementation

1. Create a review scrapper for any ecommerce website to fetch real time comments, reviews, ratings, comment tags, customer name using Python. – **CO5**
 2. Develop a mini project in a group using different predictive models techniques to solve any real life problem. - **CO5**
- (Refer link dataset- <https://www.kaggle.com/tanmoyie/us-graduate-schools-admission-parameters>)

Textbooks

1. Big Data, Black Book, DT Editorial services, 2015 edition.
2. Data Analytics with Hadoop, Jenny Kim, Benjamin Bengfort, OReilly Media, Inc.
3. Online References for data set 1) <http://archive.ics.uci.edu/ml/> 2) <https://www.kaggle.com>

Guidelines for Laboratory Conduction

- Use of Open-source software is to be encouraged.
- All the assignments should be implemented using Java/Python programming language.

Guidelines for Student's Lab Journal

1. The laboratory assignments are to be submitted by students in the form of a journal.
2. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, problem statement, theory Concepts in brief, algorithm, 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).



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

T. Y. B. Tech. Pattern 2023 Semester: VI - Information Technology 2308314A: Artificial Intelligence & Neural Network			
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: Machine Learning, Data Structures and Algorithms			
Course Outcomes: On completion of the course, students will be able to			
	Course Outcomes		Bloom's Level
CO1	Apply the uninformed search strategies to solve the various problems.		3-Apply
CO2	Apply the informed search strategies to solve the various problems.		3-Apply
CO3	Understand ANNs for image classification.		2- Understand
CO4	Understand CNNs for Object Detection and Medical Image analysis.		2- Understand
CO5	Understand RNNs for Natural Language Processing.		2- Understand
COURSE CONTENTS			
Unit I	Uninformed Search Strategies	(08 hrs.)	COs Mapped - CO1
Formulation of real world problems, Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Depth First Search, Bidirectional Search, Comparison of Uninformed search Strategies Searching with partial information, Sensor-less problems, Contingency problems			
Unit II	Informed Search Strategies	(08 hrs.)	COs Mapped – CO2
Generate & test, Hill Climbing, Best First Search, A* and AO* Algorithm, Constraint satisfaction, Game playing: Minimax Search, Alpha-Beta Cutoffs, Waiting for Quiescence			
Unit III	Artificial Neural Networks (ANN)	(08 hrs.)	COs Mapped –CO3
Basics of Neural Networks, History and Motivation, Perceptron's, Multi-Layer Perceptron's (MLPs), Back propagation, Gradient Descent Variants, Regularization Techniques, Hyper parameter Tuning, Learning Rate Scheduling, Applications of Artificial Neural Networks			
Unit IV	Convolution Neural Networks (CNN)	(08 hrs.)	COs Mapped – CO4
Introduction to Neural Networks, Motivation for CNNs, Basic Components of CNNs Architecture of CNNs, Convolution Operation ,Pooling Operation ,Implementation of Convolution and Pooling, Training CNNs, Fine-tuning and Transfer Learning, Data Augmentation, Modern Architectures, Attention Mechanisms, CNNs for Specific Applications: Object Detection, Image Segmentation, Medical Image Analysis, Natural Language Processing with CNNs.			
Unit V	Recurrent Neural Networks (RNN)	(08 hrs.)	COs Mapped – CO5

Basics of Neural Networks, Motivation for RNNs, Structure of RNNs, Architectures of RNNs, Back Propagation in RNNs, Gradient Vanishing and Exploding, Training RNNs, Sequence-to-Sequence Learning, LSTM and GRU Networks, Hierarchical RNNs and Deep RNNs, Applications of RNNs Natural Language Processing. Time Series Prediction

Textbooks

1. Elaine Rich and Kevin Knight, "Artificial Intelligence" Tata McGraw Hill
2. Stuart Russell & Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, Second edition

Reference Books

1. Ivan Bratko, "Prolog Programming For Artificial Intelligence", Second edition, Addison Wesley, 1440
2. Eugene Charniak, Drew McDermott, "Introduction to Artificial Intelligence", Addison Wesley
3. Patterson, "Introduction to AI and Expert Systems", PHI
4. Nilsson, "Principles of Artificial Intelligence", Morgan Kaufmann

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Two Assignments on Unit-1& 2 and Unit-5	06
2	One Test on Unit 3 and 4	04
3	LMS Test on each Unit	10
	Total	20



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

T. Y. B. Tech. Pattern 2023 Semester: VI - Information Technology 2308314B: 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:			
Course Outcomes: On completion of the course, students will be able to			
	Course Outcomes		Bloom's Level
CO1	Understand the basic concepts of cyber security.		2-Understand
CO2	Differentiate among different types of cyber threats and cyber-crimes.		2-Understand
CO3	Illustrate cyber forensic techniques and forensic analysis tools.		3-Apply
CO4	Understand cryptographic algorithms and protocols to maintain computer security.		2-Understand
CO5	Understand cyber-laws and other countermeasures against cybercrime.		2-Understand
COURSE CONTENTS			
Unit I	Cyber Security Principles	(06 hrs.)	COs Mapped – CO1
CIA Triad: Confidentiality Integrity & Availability, Risk Management Process: Threat Actors, Risk Identification, Risk Assessment, Risk Treatment, Security Controls: Physical Controls, Technical Controls & Administrative Controls. Governance Elements: Procedures, Policies, Standards, Regulations & Laws.			
Unit II	Cyber Crimes and Hacking	(06 hrs.)	COs Mapped – CO2
Overview of – cyber threats, cybercrime, cybercriminal Types of Threats – Malware, spyware, Sniffing, Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks, Worms, Trojans, Viruses, Backdoors. Classification of cybercrimes - cyber stalking, internet time thefts, Newsgroup Spam, software piracy, cyber terrorism, phishing, computer vandalism, computer hacking, password sniffing, spamming, cross site scripting, online auction fraud, cyber-squatting, logic bombs, web jacking, DoS attack, salami attack, data diddling, email spoofing, Types of Hacker			
Unit III	Cyber Forensics and digital Forensics	(06 hrs.)	COs Mapped – CO3
Introduction to Cyber Forensics, The need of computer forensic, challenges in cyber forensics Web Attack Forensics: Intrusion forensics, database forensics, preventive forensics; Anti- forensics practices, Anti-forensics detection techniques, Network forensics analysis tools. Malware Forensics: Malware types, Malware Analysis, Tools for analysis;			

Introduction to Digital Forensics, Cyber Forensics vs Digital Forensics, Forensic Software and Hardware properties of digital evidence, recovering and preserving digital evidence, Advanced forensic Tools, selecting and analyzing digital evidence, validating the evidence

Unit IV	Cryptography	(06 hrs.)	COs Mapped – CO4
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Introduction to Cryptography, Hashing, Encryption

Cryptography technique: Symmetric cryptography, Asymmetric cryptography

Hashing: What is Hashing, Types of Hashing in Cybersecurity: MD5, SHA-1, SHA-256, CRC32, Encryption: RSA, AES, Triple DES, Hashing vs Encryption, Steganography, Digital Signatures: DSS, X.509 certificate standard, Digital Certificate.

Unit V	Cyber Ethics and Laws	(06 hrs.)	COs Mapped – CO5
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Introduction to Cyber Laws, Need, Property, Crime against individual, E-Commerce and E-Governance, Offences under IT Act, Computer Offences and its penalty under ISO 27001, IT Act 2000, Positive Aspects and weak areas of ITA 2000, Digital signatures and the Indian ITA act, ITA 2008, and International Standards maintained for Cyber Security.

Compliance Standard: ISO 27001, ISO 20000.

Case Study: Basic Penetration Testing - Reconnaissance, Scanning, enumeration and analysis, System hacking, Post-Exploitation, Web-Application Assessment

(<https://tryhackme.com/room/googledorking>)

Textbooks

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA. ISBN 978-81-265-2179-1
2. Practical Cyber Forensics an Incident-Based Approach to Forensic Investigations, Niranjana Reddy, Apress, ISBN-13: 978-1-4842-4459-3
3. Practical Digital forensics – Richard Boddington, PACKT Publishing ISBN 978-1-78588-710-9
4. Cryptography and network security - Atulkahate, McGraw hill Publishing ISBN978-1-25902-988-2
5. Cyber Laws and IT Protection - Harish-Chander, PHI Publishing ISBN-978-8-12034-570-6

Reference Books

1. William Stallings, Computer Security: Principles and Practices, Pearson, Sixth edition, ISBN: 978-0-13-335469-0
2. Bernard Menezes, Network Security and Cryptography, Cengage Learning, ISBN-978-81-315-1349-1
3. Dr. V.K. Pachghare, Cryptography and Information security, PHI, Second edition, ISBN- 978- 81-203-5082-3

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Two Assignments on Unit-1& 2 and Unit-5	06
2	One Test on Unit 3 and 4	04
3	LMS Test on each Unit	10
	Total	20



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

T. Y. B. Tech. Pattern 2023 Semester: VI - Information Technology 2308314C: Multimedia 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: Data Structures and Algorithms, Computer Graphics			
Course Outcomes: On completion of the course, students will be able to			
	Course Outcomes		Bloom's Level
CO1	Understand basic building blocks and applications of Multimedia.		2-Understand
CO2	Apply different algorithms for text and image compression.		3-Apply
CO3	Classify different audio and video file formats of Multimedia.		2-Understand
CO4	Understand open-source authoring tools of animation.		2-Understand
CO5	Understand virtual reality and VR devices used in various applications.		2-Understand
COURSE CONTENTS			
Unit I	Introduction to Multimedia	(07 hrs.)	COs Mapped – CO1
Goals, objectives, and characteristics of multimedia, what is Multimedia, Multimedia and Hypermedia, Multimedia building blocks: text, image, audio, video, animation, Overview of Multimedia Software Tools, Multimedia Applications, Multimedia architecture, Evolving Technologies for Multimedia Systems, Some useful editing, and Authoring tools			
Unit II	Text and Image Processing	(08 hrs.)	COs Mapped – CO2
Text: Text file formats: TXT, DOC; RTF, PDF Text compression: Huffman coding, LZ & LZW Image: Image Data Representation, Image File formats - BMP, TIFF, JPEG, GIF, PNG Image processing: Acquisition, Storage, Communication, Display, Enhancement, Segmentation Types of Compression: Lossless: RLE, Shannon - Fano algorithm, Arithmetic coding. Lossy: Vector quantization, Fractal Compression Technique, Transform coding and Hybrid: JPEG-DCT Case Study: Optimizing Medical Imaging Systems Through Image Processing and Compression Techniques			
Unit III	Audio and Video Processing	(07 hrs.)	COs Mapped – CO3
Audio: Nature of sound waves, characteristics of sound waves, Use of audio in computer applications, psycho-acoustic, MIDI, Digital audio file formats: AIFF, VOC, AVI, WMA, OGG, PCM, MP3, AAC Audio compression techniques: DM, ADPCM and MPEG. Video: video signals formats, Video transmission standards: EDTV, CCIR, CIF, SIF, HDTV, Video file formats: AVI, MOV, RM, WAV, FLV, 3GP, Video editing, Video Compression: H-261,H-263, MPEG			

Unit IV	Animation	(07 hrs.)	COs Mapped – CO4
Animation: Historical Background, Uses of Animation, Traditional Animation, Principal of Animation, Techniques of animation, Computer based Animation, Animation on the Web, 3D Animation, Rendering Algorithms, Animation File formats, Animation tools: Autodesk Maya Gaming: Facial Recognition, Voice Recognition, Gesture Control, High-Def Displays, Augmented Reality, Mobile Gaming, Cloud Gaming On-Demand Gaming. VFX: Visual Effect and Special Effect, why use Visual Effect, Blender VFX software.			
Unit V	Virtual Reality	(07 hrs.)	COs Mapped – CO5
Architecture of VR, Concept and History of VR, Human Physiology and Perception, Forms of VR, VR applications, VR devices: Hand Gloves, Head mounted tracking system, VR chair, CCD, VCR, 3D Sound System, Head mounted display, Touchable Holograms Case Study: Demo of HTC Vive Focus Plus VR headset/ Oculus			
Textbooks			
1. Ralf Steinmetz and Klara Nahrstedt "Multimedia Computing, Communication and Applications", Pearson Education. 2. Ranjan Parekh, "Principles of Multimedia", 2/E, TataMcGraw-Hill, ISBN:1259006506			
Reference Books			
1. Ze-Nian Li, Marks S. Drew, "Fundamentals of Multimedia", Pearson Education. 2. Gonzalez, Woods, "Digital Image Processing" Addison Wesley. 3. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, 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	Two Assignments on Unit-1& 2 and Unit-5	06
2	One Test on Unit 3 and 4	04
3	LMS Test on each Unit	10
	Total	20



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

T. Y. B. Tech. Pattern 2023 Semester: VI - Information Technology 2308315A: 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: Communication Networks, Operating Systems			
Course Outcomes: On completion of the course, students will be able to			
	Course Outcomes		Bloom’s Level
CO1	Articulate the main concepts, key technologies and fundamentals of cloud computing.		2-Understand
CO2	Understand cloud enabling technologies and virtualization.		2-Understand
CO3	Analyse various cloud programming models and apply them to solve problems on the cloud.		4-Analyse
CO4	Understand data storage and major security issues in the cloud.		2-Understand
CO5	Understand trends in ubiquitous cloud and internet of things.		2-Understand
COURSE CONTENTS			
Unit I	Fundamentals of Cloud Computing	(08 hrs.)	COs Mapped– CO1
Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges, Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models, Federated Cloud/Intercloud, Types of Clouds.			
Unit II	Cloud-Enabling Technology and Virtualization	(08 hrs.)	COs Mapped – CO2
Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology Virtualization Technology, Web Technology, Multitenant Technology, Service Technology. Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation			
Unit III	Common Standards and Cloud Platforms	(08 hrs.)	COs Mapped – CO3
Common Standards: The Open Cloud Consortium, Open Virtualization Format, Standards for Application Developers: Browsers (Ajax), Data (XML, JSON), Solution Stacks (LAMP and LAPP), Syndication (Atom, Atom Publishing Protocol, and RSS), and Standards for Security. Amazon web services: Compute services Storage Services Communication Services Additional services Google AppEngine: Architecture and core concepts, Application life cycle, Cost model Microsoft Azure: Azure core concepts, SQL Azure, Windows Azure platform appliance.			
Unit IV	Data Storage and Security in Cloud	(07 hrs.)	COs Mapped – CO4
Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo Cloud data stores: Datastore and Simple DB Gautam Shrauf, Cloud Storage-Overview, Cloud Storage Providers. Securing the Cloud-			

General Security Advantages of Cloud-Based Solutions, Introducing Business Continuity and Disaster Recovery. Disaster Recovery- Understanding the Threats.			
Unit V	Ubiquitous Clouds and the Internet of Things	(07 hrs.)	COs Mapped – CO5
Cloud Trends in Supporting Ubiquitous Computing, Performance of Distributed Systems and the Cloud, Enabling Technologies for the Internet of Things (RFID, Sensor Networks and ZigBee Technology, GPS), Innovative Applications of the Internet of Things (Smart Buildings and Smart Power Grid, Retailing and Supply-Chain Management, Cyber-Physical System), Online Social and Professional Networking. How the Cloud Will Change Operating Systems, Location-Aware Applications, Intelligent Fabrics, Paints, and More.			
Textbooks			
1. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, First edition 2. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, 2010, The McGraw-Hill			
Reference Books			
1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill, ISBN: 978 1259029950, 1259029956. 2. Gautam Shrof, “ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications, Cambridge University Press, ISBN: 9780511778476. 3. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, ISBN :9788131776513.			

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Two Assignments on Unit-1 & 2, Unit 5	06
2	One Test on Unit-3 & 4	04
3	LMS Test on each Unit	10
	Total	20



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

T. Y. B. Tech. Pattern 2023 Semester: VI - Information Technology 2308315B: Software Modeling and Design			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory: 03 hrs./week		03	Continuous Comprehensive Evaluation: 20 Marks InSem Exam: 20 Marks EndSem Exam: 60 Marks
Prerequisite Courses: Object-oriented Programming, Software Engineering, Database Management System			
Course Outcomes: On completion of the course, students will be able to			
	Course Outcomes		Bloom's Level
CO1	Understand basics of Object-Oriented methodologies and Unified Modeling Language (UML).		2-Understand
CO2	Apply analysis process, use case modeling, domain/class modeling.		3-Apply
CO3	Design interaction and behavior modeling on a given system.		3-Apply
CO4	Understand Object Oriented design process and view layer design.		2-Understand
CO5	Explore architectural design principles and guidelines in the various types of application development.		2-Understand
COURSE CONTENTS			
Unit I	Introduction to OOM and UML	(07 hrs.)	COs Mapped-CO1
Introduction to Object Oriented Methodology- Study of various design methodologies like Object Oriented Design by Booch, Object Modelling Techniques by Rumbaugh, Object-Oriented Analysis by Codd Yourdon and Object-Oriented Software Engineering by Ivar Jacobson Unified Approach – Unification of Booch, Rumbaugh and Jacobson methodologies, Object - Oriented Analysis, Object Oriented Design, Iterative Development & Continuous Testing, Modelling based on UML , Layered Approach Unified Modeling Language – Introduction to Modeling and UML2.0, MDA, UML2.0 Structure, UML Building Blocks, UML common Mechanisms, Introduction to all UML2.0 Diagram notational Techniques, 4+1View			
Unit II	Object Oriented Analysis	(07 hrs.)	COs Mapped – CO2
Object Oriented Analysis Process: Use Case Modeling: Actor Identification, Actor Classification, Actor Generalization, Use Case Identification, Uses/Include/Extend Association, Writing a formal use case, Forward Engineering (Use case realization) Class Modeling: Approach for identifying class, Approaches for identifying classes, Class pattern approach, Class Responsibilities, Collaboration Approach, Naming Classes, Class associations Generalization specialization relationship, Aggregation and Composition Relationships			
Unit III	Interaction and Behavior Modeling	(08 hrs.)	COs Mapped – CO3
Activity Diagram: Activity and Actions, Activity Edge, Decision and Merge Points, Fork-Join, Control Flow, Constraints on Action, Swim Lanes. Sequence Diagram: Context, Objects and Roles, Links, Object Life Line, Message or stimulus,			

Activation/Focus of Control, delete object, Modelling Interactions. Collaboration Diagram: Objects and Links, Messages and stimuli, Active Objects, Communication Diagram, Iteration Expression, Parallel Execution, Guard Expression, Timing Diagram. State Diagram: State Machine, Triggers and Ports, Transitions and conditions, Initial and Final State, nested state, Composite States, Submachine States.			
Unit IV	Object Oriented Design Process	(08 hrs.)	COs Mapped – CO4
Object Oriented Design Process: Designing Business Layer: Object Oriented Constraints Language (OCL), Designing Business Classes: The Process, Designing Well Defined Class Visibility, Attribute Refinement, Method Design Using UML Activity Diagram, Packaging and Managing Classes. Designing Access Layer: Object Relational Systems, Object Relation Mapping, Table Class Mapping, Table — Inherited Classes Mapping, Designing the Access Layer Classes: create mirror classes, identify access layer class relationships, eliminate redundant classes, create method classes. Designing View Layer: View Layer Classes Design, Identifying View Classes by Analyzing Use Cases, Macro-Level Design Process – identify view layer objects, and build prototype for view layer Interface. Test Usability and User satisfaction: Component and Deployment Design using Component and Deployment Diagram			
Unit V	Software Design Principles and Patterns and Architectural Design	(09 hrs.)	COs Mapped – CO5
Introduction and need of Design Principles: General Responsibility Assignment Software Patterns (GRASP): Introduction, Creator, Information Expert, Low coupling, Controller, High Cohesion, Polymorphism, Pure fabrication, Indirection, Protected Variations. Introduction to GOF design patterns: Types of design patterns: Creational Pattern: Singleton, Factory Structural Pattern: Adapter, Façade Behavioral Patterns: Strategy, State Anatomy of Software Architecture, Quality attributes in architecture design, Designing Object-Oriented Software Architecture, Designing Client/Server Software Architecture, Designing Service-Oriented Architectures, Designing Component-Based Software Architectures, Designing Concurrent and Real-Time Software Architectures. Product Line Architecture design			
Textbooks			
1. Ali Bahrami, Object Oriented systems Development using Unified Modelling Language McGraw – Hill, International Editions 1999, ISBN: 0-07-1160090-6 2. Erich Gamma et al, Design Patterns: Elements of Reusable Object, Pearson, First edition, ISBN:9789332555402, 9332555400			
Reference Books			
1. Object-Oriented Analysis and Design with Applications, Third Edition by Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen, and Kelli Houston, 2007 2. An introduction to Software Architecture by Shaw & Garlan, http://sunnyday.mit.edu/16.355/intro_softarch.pdf 3. Hassan Gomaa, Software Modeling And Design UML, Use Cases, Pattern, & Software Architectures, Cambridge University Press, ISBN: 978-0-521-76414-8			

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Two Assignments on Unit-1 & 2, Unit 5	06
2	One Test on Unit-3 & 4	04
3	LMS Test on each Unit	10
	Total	20



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

T. Y. B. Tech. Pattern 2023 Semester: VI - Information Technology 2308316A: Cloud Computing Lab		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical: 02 hrs./week	01	Term work: 25 Marks Practical: 25 Marks
Prerequisite Courses: Communication Networks, Operating System		
Course Outcomes: On completion of the course, students will be able to		
	Course Outcomes	Bloom's Level
CO1	Articulate the main concepts, key technologies and fundamentals of cloud computing.	2-Understand
CO2	Apply cloud enabling technologies and virtualization.	3-Apply
CO3	Analyse various cloud programming models and apply them to solve problems on the cloud.	4-Analyse
CO4	Apply data storage and major security issues in the cloud.	3-Apply
List of Laboratory Experiments / Assignments		
Sr. No.	Laboratory Experiments / Assignments	CO Mapped
1	Study the Cloud Computing key terminologies and different Cloud platforms (CAE, AWS, Microsoft Azure).	CO1
2	Install Google App Engine. Create hello world app and other simple web applications using python/java.	CO1
3	Use GAE launcher to launch the web applications.	CO2
4	Find a procedure to transfer the files from one virtual machine to another virtual machine.	CO2
5	Find a procedure to launch a virtual machine using AWS.	CO3
6	Design and deploy a web application in a PaaS environment.	CO3
7	Create a Lambda function that triggers on S3 upload or HTTP call.	CO4
8	Design an Assignment to retrieve, verify, and store user credentials using Firebase Authentication, the Google App Engine standard environment, and Google Cloud Data store.	CO4
Guidelines for Laboratory Conduction		
All the assignments should be conducted on multicore hardware and 64-bit open-source software.		
Guidelines for Student's Lab Journal		
1. The laboratory assignments are to be submitted by students in the form of a journal. 2. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, problem statement, theory Concepts in brief, algorithm, test cases and conclusions). Program codes with sample outputs shall be submitted in soft form.		
Guidelines for Term work Assessment		

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



K. K. Wagh Institute of Engineering Education and Research, Nashik
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T. Y. B. Tech. Pattern 2023 Semester: VI - Information Technology 2308316B: Software Modeling and Design Lab		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical: 02 hrs./week	01	Term work: 25 Marks Practical: 25 Marks
Prerequisite Courses: Object-oriented Programming, Software Engineering, Database Management System		
Course Outcomes: On completion of the course, students will be able to		
	Course Outcomes	Bloom's Level
CO1	Understand basics of Object-Oriented methodologies and Unified Modeling Language (UML).	2-Understand
CO2	Apply analysis process, use case modeling, domain/class modeling.	3-Apply
CO3	Design interaction and behavior modeling on a given system.	3-Apply

List of Laboratory Experiments / Assignments		
Sr. No.	Laboratory Experiments / Assignments	COs Mapped
1	Write Problem Statement and draw Use Case diagrams for Mini Project Identify Project of enough complexity, which has at least 4-5 major functionalities. Identify stakeholders and actors and write detail problem statements for your system. Identify Major Use Cases, Identify actors. Write formal Use Case specifications for all major Use Cases.	CO2
2	Prepare Dynamic Model for the system. Identify Activity states and Action states. Draw Activity diagram with Swim lanes and fork-joins using UML 2.0 Notations for major Use Cases Draw Sequence Diagram Using UML 2.0 notations for major Use Cases.	CO2, CO3
3	Prepare Static Model for the System. Draw class diagram using UML 2.0 notations. Prepare a Data Dictionary for the databases. Draw Deployment diagram UML 2.0 notations	CO3
4	Consider your neighboring travel agent from whom you can purchase flight tickets. To book a ticket you need to provide details about your journey i.e., on which date and at what time you would like to travel. You also need to provide your address. The agency has recently been modernized. So, you can pay either by cash or by card. You can also cancel a booked ticket later if you decide to change your plan. In that case you need to book a new ticket again. Your agent also allows you to book a hotel along with flight ticket. While cancelling a flight ticket you can also cancel hotel booking. Appropriate refund as per policy is made in case of cancellation. Perform the following tasks and draw the use case diagram using UML tool. a. Identify the use cases from a given non-trivial problem	CO2, CO3

	statement. b. Identify the primary and secondary actors for a system. c. Use to generalization of use cases and «include» stereotypes to prevent redundancy in the coding phase	
5	Consider a library, where a member can perform two operations: issue book and return it. A book is issued to a member only after verifying his credentials. Develop a use case diagram for the given library system by identifying the actors and use cases and associate the use cases with the actors by drawing a use case diagram. Use UML tool	CO1, CO2, CO3
6	Consider the online shopping system. Draw the sequence diagram using UML tool to show message exchanges	CO2, CO3
7	Outputs and Code demonstration (10 hrs.) Write the code for the Mini Project. Execute the code and record the output screens	CO1, CO2, CO3
Guidelines for Laboratory Conduction		
1. It is appreciated if the assignments are based on real world problems/applications. 2. Any open-source UML designing tool like StarUML, Visual Paradigm, Umbrello, AgroUML, can be used to draw UML diagram. Languages and databases : JAVA, MySQL, MongoDB, 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, test cases and conclusions). Program codes with sample outputs shall be submitted in soft form.		
Guidelines for Term work Assessment		
1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignments, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with diagrams specified in the assignment, implementation (wherever applicable) attendance etc. 2. Examiners will judge the understanding of the practical/ oral performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out. 3. Appropriate knowledge of the usage of software and hardware should be checked by the concerned faculty member(s).		



K. K. Wagh Institute of Engineering Education and Research, Nashik
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T. Y. B. Tech. Pattern 2023 Semester: VI - Information Technology 2308317: Communication Networks			
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, if any: - Data Communication			
Course Outcomes: On completion of the course, students will be able to			
	Course Outcomes		Bloom's Level
CO1	Understand fundamental concepts of Computer Networks, protocols and technologies.		2-Understand
CO2	Explore the working and functions of data link layer.		2-Understand
CO3	Understand the working of different routing protocols and mechanisms.		2-Understand
CO4	Implement client-server applications using sockets.		3-Apply
CO5	Explore responsibilities, services offered, and protocol used at application layer of network.		2-Understand
COURSE CONTENTS			
Unit I	Introduction to Computer Network	(07 hrs.)	COs Mapped – CO1
Basics of Computer Networks, Network Devices, Network Software, Protocol Layering. Reference Models: OSI, TCP/IP, Comparison of OSI & TCP/IP. Physical Layer: Guided Media, Unguided Media, And Wireless Transmission: Electromagnetic Spectrum, Switching: Circuit-Switched Networks, Packet Switching, and Structure of a Switch.			
Unit II	Data Link Layer	(07 hrs.)	COs Mapped – CO2
DLL Design Issues (Services, Framing, Error Control, Flow Control), Elementary Data Link protocols: Stop and Wait, Sliding Window (Go Back N, Selective Repeat), Piggybacking, HDLC. Medium Access Protocols: Random Access, Controlled Access, Channelization, Ethernet Protocol: Standard Ethernet, Fast Ethernet (100 Mbps), Gigabit Ethernet, 10- Gigabit Ethernet, Wireless standards, Bluetooth.			
Unit III	Network Layer	(08 hrs.)	COs Mapped – CO3
Network Layer Services, Packet Switching, Network Layer Performance, IPv4 Addressing (Classful and Classless), Subnetting, Supernetting, IPv4 Protocol, DHCP, Network Address Translation (NAT). Routing Algorithms: Distance Vector Routing, Link State Routing, Path Vector Routing. Protocols – RIP, OSPF, BGP. Next Generation IP: IPv6 Addressing, IPv6 Protocol, Transition from IPV4 to IPV6.			

Unit IV	Transport layer	(09 hrs.)	COs Mapped – CO4
Transport Layer: Transport Layer Services, Connectionless & Connection-Oriented Protocols. Transport Layer Protocols: User Datagram Protocol: UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, A TCP Connection, Windows in TCP, Flow Control, Error Control, TCP Congestion Control, TCP Timers.			
Unit V	Application Layer	(07 hrs.)	COs Mapped – CO5
Client Server Paradigm: Communication using TCP and UDP, Peer to Peer Paradigm, Application Layer Protocols: DNS, FTP, TFTP, HTTP, SMTP, POP, IMAP, MIME, and Network Management: SNMP.			
Textbooks			
1. A. Tanenbaum, Computer Networks, Pearson 2. B. Forouzan, Data Communications and Networking, McGraw Hill			
Reference Books			
1. B. Forouzan, TCP/IP Protocol Suite, McGraw Hill 2. Andrew S. Tanenbaum, David J. Wetherall, Computer Network, Pearson Education, ISBN: 978-0-13-212695 3. Kurose Ross, Computer Networking: A Top Down Approach Featuring the Internet, Pearson Education, ISBN: 978-81-7758-878			

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Two Assignments on Unit-1 & 2, Unit 5	06
2	One Test on Unit-3 & 4	04
3	LMS Test on each Unit	10
	Total	20



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T. Y. B. Tech. Pattern 2023 Semester: V Information Technology 2308318: Bioinformatics			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Theory: 02 hrs./week		02	Continuous Comprehensive Evaluation: 50 Marks
Prerequisite Courses, if any: -Basics of biology, Design and Analysis of Algorithms			
Course Outcomes: On completion of the course, students will be able to–			
	Course Outcomes		Bloom’s Level
CO1	Integrate biological concepts with information technologies to study the biological system.		2-Understand
CO2	Understand Gene structure, various biological databases, and methods to manage the different types of biological data.		2-Understand
CO3	Describe principles and algorithms of pairwise and multiple alignments.		2-Understand
CO4	Understand various bioinformatics tools and algorithm.		2-Understand
COURSE CONTENTS			
Unit I	Basics of Bioinformatics	(06 hrs.)	COs Mapped – CO1
What is Bioinformatics and its relationship with molecular biology, Information Theory and Central Dogma of Molecular Biology, Bioinformatics Scope, Challenges and Bioinformatics Applications, Features and Major Databases in Bioinformatics, Interdisciplinary nature of Bioinformatics, Major Bioinformatics databases and tools.			
Unit II	Biological database and Gene Structure	(06 hrs.)	COs Mapped – CO2
Types of biological Database, Primary, Secondary and Structural data bases, tools for web search, data retrieval tools Protein primary databases - PIR, SWISS-PROT; Composite protein sequence database - NRDB, OWL, Protein secondary databases - PROSITE, Profiles; Database on protein structures – PDB, Genome databases - human (HGP) What is a Gene? Structural Genes, Genome Sequencing and Applications of Genetics Maps			
Unit III	Sequence Alignment and Data Visualization	(06 hrs.)	COs Mapped – CO3
Introduction to Sequence alignments and dynamic programming; Local alignment and Global Alignment. Methods of Sequence Alignments, Scoring Matrix: PAM and BLOSUM Sequence Visualization, Sequence maps, Structure Visualization and rendering tools, Statistical Concepts Microarray.			
Unit IV	Bioinformatics Algorithm and Tools	(06 hrs.)	COs Mapped – CO4
Biological algorithm vs. computer algorithms, Clustering, and classification algorithms FASTA Algorithm, BLAST Algorithm and its comparison, Hidden Markov Models, Graph and Genetics Algorithm.			
Textbooks			
1. S. C. Rastogi, N. Mendiratta, P. Rastogi ‘Bioinformatics-Methods & Application Genomics, Proteomics and Drug Discovery’, Third edition, Prentice Hall of India 2. Bryan Bergeron. ‘Bioinformatics Computing’. Pearson Education			

3. Orpita Bosum Simminder Kaur Thukral 'Bioinformatics: Databases, Tools and Algorithms', Oxford press

Reference Books

1. Supratim Choudhuri, "BIOINFORMATICS FOR BEGINNERS Genes, Genomes, Molecular Evolution, Databases and Analytical Tools", Academic Press is an imprint of Elsevier
2. Baxevanis, A. D. and Ouellette. B. F. F. 2004. Bioinformatics: A practical guide to the analysis of genes and proteins. Wiley Inter-science. New York. 560 p.

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	One Assignment on each Unit (4*5)	20
2	One MCQ Test on each Unit (4*5)	20
3	One Case Study/Presentation	10
	Total	50



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T. Y. B. Tech. Pattern 2023 Semester: VI - Information Technology 2308319: Network and Hardware Support			
Teaching Scheme:		Credit Scheme:	Examination Scheme:
Tutorial: 01 hr./week Practical: 02 hrs./week		01 01	Tutorial: 25 Marks Oral: 25 Marks
Prerequisite Courses: Data Communication			
Course Outcomes: On completion of the course, students will be able to			
	Course Outcomes		Bloom's Level
CO1	Understand fundamental concepts of Networking devices and Components.		2-Understand
CO2	Design small size networks using different topologies.		3-Apply
CO3	Implement different routing protocols and mechanisms.		3-Apply
CO4	Implement client-server applications using sockets.		3-Apply
CO5	Analyse the performance of Application layer protocol.		4-Analyse
COURSE CONTENTS			
Unit I	Network and Hardware fundamentals	(04 hrs.)	COs Mapped – CO1
Networking Devices, Network components: Routers , Controllers, Servers,L2 and L3 switches, Endpoints, Firewalls and IPS, Accent points, Protocols. Physical interface and cabling types comparison: Single-mode fiber, Copper, Multimode fiber, Connections, PoE			
Unit II	Network Interfacing	(03 hrs.)	COs Mapped – CO2
Types of Network Topology, communication media, Crimping procedure, color band, LAN cabling types, different networking command and their purpose.			
Unit III	IP Connectivity	(04 hrs.)	COs Mapped – CO3
Interpret the components of routing Table, IPv4 and IPv6 Static Routing, Default route, Floating static Route, TCP and UDP Socket Programming, Network Address Translation (NAT).			
Unit IV	Security Fundamentals	(02 hrs.)	COs Mapped – CO4
Configuration of password, Remote access and site-site VPN, ACL Switch port security, Application Layer Protocols functions			
Textbooks			
1. B. Forouzan, Data Communications and Networking, McGraw Hill			
Reference Books			
1. B. Forouzan, TCP/IP Protocol Suite, McGraw Hill			
2. Andrew S. Tanenbaum, David J. Wethrall, Computer Network, Pearson Education, ISBN: 978-0-13-212695			
3. Kurose Ross, Computer Networking: A Top Down Approach Featuring the Internet, Pearson Education, ISBN: 978-81-7758-878			

Sr. No.	Laboratory Experiments / Assignments	CO Mapped
1	Execute and analyse basic networking commands: ifconfig, ip, traceroute, tracepath, ping, netstat, ss, dig, nslookup, route, host, arp, hostname, curl or wget, mtr, whois, tcpdump.	CO1
2	Demonstrate the different types of topologies and types of transmission media by using a packet tracer tool.	CO1, CO2
3	Setup a WAN which contains wired as well as wireless LAN by using a packet tracer tool. Demonstrate transfer of a packet from LAN 1 (wired LAN) to LAN2 (Wireless LAN).	CO1. CO2
4	Implement Link State Routing Protocols.	CO3
5	Implement Distance Vector Routing Protocols	CO3
6	Implement Socket Programming using TCP with C/Java/python: TCP Client, TCP Server.	CO4
7	Implement Socket Programming using UDP with C/Java/python: UDP Client, UDP Server.	CO4
8	Study and Analyse the performance of HTTP, HTTPS and FTP protocol using Packet tracer tool.	CO5
Guidelines for Laboratory Conduction		
1. Use of open-source software is to be encouraged. 2. Operating System recommended: - Windows, Linux 3. Programming tools recommended: -Cisco Packet Tracer, C/Java/Python Editor		
Guidelines for Student's Lab Journal		
1. The laboratory assignments are to be submitted by students in the form of a journal. 2. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, problem statement, theory Concepts in brief, algorithm, test cases and conclusions). Program codes with sample outputs shall be submitted in soft form.		
Guidelines for Term work Assessment		
1. Continuous assessment of laboratory work shall be based on the overall performance of a student. 2. 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).		



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T. Y. B. Tech. Pattern 2023 Semester: VI -Information Technology 2308320: Project Based Seminar		
Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory: 02 hrs./week	01	Term work: 50 Marks
Prerequisite Courses: Communication Skills		
Course Outcomes: On completion of the course, students will be able to		
	Course Outcomes	Bloom's Level
CO1	To Gather, organize, summarize and interpret technical literature with the purpose of formulating a project proposal.	2-Understand
CO2	To write a technical report summarizing state-of-the-art on an identified topic.	2-Understand
CO3	Present the study using graphics and multimedia presentations.	2-Understand
CO4	Define intended future work based on the technical review.	2-Understand
CO5	To explore and enhance the use of various presentation tools and techniques.	2-Understand
CO6	To understand scientific approach for literature survey and paper writing.	2-Understand
COURSE CONTENTS		
Guidelines for Project Based Seminars		
1. A project group consisting of 3 to 4 students shall identify problem(s) in Computer Engineering / Information Technology referring to recent trends and developments in consultation with institute guide. 2. The group must review sufficient literature (reference books, journal articles, conference papers, white papers, magazines, web resources etc.) in relevant area on their project topic as decided by the guide. 3. Internal guide shall define a project statement based on the study by student group. 4. Students should identify individual seminar topic based on the project undertaken in consultation with guide. 5. Seminar topics should be based on project undertaken. Guide should thoughtfully allocate seminar topics on different techniques to solve the given problem (project statement), comparative analysis of the earlier algorithms used or specific tools used by various researchers. 6. Research articles could be referred from IEEE, ACM, Science direct, Springer, Elsevier, IETE, CSI or from freely available digital libraries like Digital Library of India (dli.ernet.in), National Science Digital Library, JRD Tata Memorial Library, citeseerx.ist.psu.edu, getcited.org, arizona.openrepository.com, Open J-Gate, Research Gate, worldwidescience.org etc. 7. The group shall present the study as individual seminars in 20 – 25 minutes.		
Guidelines for Seminar Report		
1. Each student shall submit two copies of the seminar report in a prescribed format duly signed by the guide and Head of the department/Principal. 2. First chapter of a project group may talk about the project topic. At the end of the first chapter		

individual students should begin with the introduction of seminar topic and its objectives. 3. Broad contents of review report (20-25 pages) shall be - Introduction of Project Topic - Motivation, purpose and scope of project and seminar - Related work (of the seminar title) with citations - Discussion (your own reflections and analysis) - Conclusions - Project definition. (Short version of RUP's vision document if possible). vii. References in IEEE Format 4. Students are expected to use open-source tools for writing seminar reports, citing references and plagiarism detection. (Latex, Lex for report writing, Mendeley, Zatero for collecting, organizing and citing the resources; DupliChecker , PaperRater, PlagiarismChecker and Viper for plagiarism detection) Guidelines for Seminar Evaluation - A panel of examiners will assess the seminar externally during the presentation. - Attendance for all seminars for all students is compulsory. - Criteria for evaluation - Relevance of topic - 05 Marks - Relevance + depth of literature reviewed- 10 Marks - Seminar report (Technical Content) - 10 Marks - Seminar report (Language) - 05 Marks - Presentation Slides - 05 Marks - Communication Skills - 05 Marks - Question and Answers - 10 Marks Guidelines for Seminar Presentation - A panel of examiners will evaluate the viability of project scope and seminar delivery. - Oral examination in the form of a presentation will be based on the project and seminar work completed by the candidates. - Seminar report must be presented during the oral examination.	
Textbooks	
- Sharon J. Gerson, Steven M. Gerson, Technical Writing: Process and Product, Pearson Education Asia, ISBN :130981745, Fourth edition - Andrea J. Rutherford, Basic Communication Skills for Technology, Pearson Education Asia, Second edition - Lesikar, Lesikar's Basic Business Communication, Tata McGraw, ISBN :256083274, First edition	