Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and Detailed Syllabus (DJS22)

Third Year B. Tech

in

INFORMATION TECHNOLOGY

(Semester V and VI)

Revision: 2 (2022)
With effect from the Academic Year: 2024-2025

1st July 2024

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

Scheme for Third Year Undergraduate Program in Information Technology: Semester V (Autonomous)
(Academic Year 2024-2025)
SEMESTER V

Sr. No.	Course Code	Course	Teaching Scheme				Semester End Examination (A)						Continuous Assessment (B)					Aggregate (A+B)	Credits Earned	
			Theory (hrs)	Practical (hrs)	Tut (hrs)	Credits	Duration (hrs)	Theory	Oral	Pract	Oral & Pract	SEE Total (A)	Term Test 1 (TT1)	Term Test 2 (TT2)	Total (TT1 & TT2)	Term Work Total	CA Total (B)			
1	DJS22ITC501	Artificial Intelligence	3	--	--	**3**	2	65	--	--	--	**65**	20	15	35	--	**35**	**100**	**3**	**4**
	DJS22ITL501	Artificial Intelligence Lab	--	2	--	**1**	--	--	25	--	--	**25**	--	--	--	25	**25**	**50**	**1**	
2	DJS22ITC502	Advanced Data Structures	3	--	--	**3**	2	65	--	--	--	**65**	20	15	35	--	**35**	**100**	**3**	**4**
	DJS22ITL502	Advanced Data Structures Lab	--	2	--	**1**	--	--	25	--	--	**25**	--	--	--	25	**25**	**50**	**1**	
3	DJS22ITC503	Data Warehousing and Mining	3	--	--	**3**	2	65	--	--	--	**65**	20	15	35	--	**35**	**100**	**3**	**4**
	DJS22ITL503	Data Warehousing and Mining Lab	--	2	--	**1**	--	--	25	--	--	**25**	--	--	--	25	**25**	**50**	**1**	
4	DJS22ITC504	Cryptography and Network Security	3	--	--	**3**	2	65	--	--	--	**65**	20	15	35	--	**35**	**100**	**3**	**4**
	DJS22ITL504	Cryptography and Network Security Lab	--	2	--	**1**	--	--	25	--	--	**25**	--	--	--	25	**25**	**50**	**1**	
5@	DJS22ITC5011	Microcontrollers and Embedded Systems	3	--	--	**3**	2	65	--	--	--	**65**	20	15	35	--	**35**	**100**	**3**	**4**
	DJS22ITL5011	Microcontrollers and Embedded Systems Lab	--	2	--	**1**	--	--	25	--	--	**25**	--	--	--	25	**25**	**50**	**1**	
	DJS22ITC5012	Computer Graphics	3	--	--	**3**	2	65	--	--	--	**65**	20	15	35	--	**35**	**100**	**3**	
	DJS22ITL5012	Computer Graphics Lab	--	2	--	**1**	--	--	25	--	--	**25**	--	--	--	25	**25**	**50**	**1**	
	DJS22ITC5013	Statistical Analysis	3	--	--	**3**	2	65	--	--		**65**	20	15	35	--	**35**	**100**	**3**	
	DJS22ITL5013	Statistical Analysis Lab	--	2	--	**1**	--	--	25	--	--	**25**	--	--	--	25	**25**	**50**	**1**	
6#	DJS22IHL	Professional and Business Communication Lab	--	4	--	**2**	--	--	--	--	--	--	--	--	--	50	**50**	**50**	**2**	**2**
7	DJS22ILLL1	Innovative Product Development III	--	2	--	**1**	--	--	25	--	--	**25**	--	--	--	25	**25**	**50**	**1**	**1**
		Total	**15**	**16**	**--**	**23**	**10**	**325**	**150**	**--**	**--**	**475**	**100**	**75**	**175**	**200**	**375**	**850**	**23**	

@ Any 1 elective course # 2 hrs. of theory (class wise) and 2 hrs of activity-based laboratory (batch wise)

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Scheme for Third Year Undergraduate Program in Information Technology: Semester VI (Autonomous)
(Academic Year 2024-2025)
SEMESTER VI

Sr. No.	Course Code	Course	Teaching Scheme				Semester End Examination (A)						Continuous Assessment (B)					Aggregate (A+B)	Credits Earned	
			Theory (hrs)	Practical (hrs)	Tut (hrs)	Credits	Duration (hrs)	Theory	Oral	Pract	Oral & Pract	SEE Total (A)	Term Test 1 (TT1)	Term Test 2 (TT2)	Total (TT1 & TT2	Term Work Total	CA Total (B)			
1	DJS22ITC601	Software Engineering	3	--	--	**3**	2	65	--	--	--	**65**	20	15	35	--	**35**	**100**	3	**4**
	DJS22ITL601	Software Engineering Lab	--	2	--	**1**	--	--	25	--	--	**25**	--	--	--	25	**25**	**25**	1	
2	DJS22ITC602	Machine Learning	3	--	--	**3**	2	65	--	--	--	**65**	20	15	35	--	**35**	**100**	3	**4**
	DJS22ITL602	Machine Learning Lab	--	2	--	**1**	--	--	25	--	--	**25**	--	--	--	25	**25**	**25**	1	
3	DJS22ITC603	Image Processing and Computer Vision	3	--	--	**3**	2	65	--	--	--	**65**	20	15	35	--	**35**	**100**	3	**4**
	DJS22ITL603	Image Processing and Computer Vision Lab	--	2	--	**1**	--	--	25	--	--	**25**	--	--	--	25	**25**	**25**	1	
4	DJS22ITL604	Full Stack Web Development Lab	--	2	--	**1**	2	--	--	--	25	**25**	--	--	--	25	**25**	**50**	1	**1**
5 & 6@	DJS22ITC6011	Infrastructure Security	3	--	--	**3**	2	65	--	--	--	**65**	20	15	35	--	**35**	**100**	3	**8**
	DJS22ITL6011	Infrastructure Security Lab	--	2	--	**1**	--	--	25	--	--	**25**	--	--	--	25	**25**	**25**	1	
	DJS22ITC6012	Internet of Things	3	--	--	**3**	2	65	--	--	--	**65**	20	15	35	--	**35**	**100**	3	
	DJS22ITL6012	Internet of Things Lab	--	2	--	**1**	--	--	25	--	--	**25**	--	--	--	25	**25**	**25**	1	
	DJS22ITC6013	Augmented Reality and Virtual Reality	3	--	--	**3**	2	65	--	--	--	**65**	20	15	35	--	**35**	**100**	3	
	DJS22ITL6013	Augmented Reality and Virtual Reality Lab	--	2	--	**1**	--	--	25	--	--	**25**	--	--	--	25	**25**	**25**	1	
	DJS22ITC6014	Big Data Analytics	3	--	--	**3**	2	65	--	--	--	**65**	20	15	35	--	**35**	**100**	3	
	DJS22ITL6014	Big Data Analytics Lab	--	2	--	**1**	--	--	25	--	--	**25**	--	--	--	25	**25**	**25**	1	
	DJS22ITC6015	Information Systems and IT Governance	3	--	--	**3**	2	65	--	--	--	**65**	20	15	35	--	**35**	**100**	3	
	DJS22ITL6015	Information Systems and IT Governance Lab	--	2	--	**1**	--	--	25	--	--	**25**	--	--	--	25	**25**	**25**	1	
7	DJS22ILLL2	Innovative Product Development IV	--	2	--	**1**	--	--	--	--	25	**25**	--	--	--	--	**25**	**25**	1	1
		Total	**15**	**14**	**3**	**22**	**12**	**325**	**125**	**0**	**50**	**450**	**100**	**75**	**175**	**150**	**325**	**775**	**22**	

@ Any 2 elective courses

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Continuous Assessment (A):

Course	Assessment Tools	Marks	Time (hrs.)
Theory	a. One Term test (based on 40 % syllabus)	20	1
	b. Second Term test (next 40 % syllabus) / presentation / assignment / course project / group discussion / any other.	15	1
	Total marks (a + b)	35	--
Audit course	Performance in the assignments / quiz / power point presentation / poster presentation / group project / any other tool.	--	As applicable
Laboratory	Performance in the laboratory and documentation.	25	
Tutorial	Performance in each tutorial & / assignment.	25	
Laboratory &Tutorial	Performance in the laboratory and tutorial.	50	

The final certification and acceptance of term work will be subject to satisfactory performance upon fulfilling minimum passing criteria in the term work / completion of audit course.

Semester End Assessment (B):

Course	Assessment Tools	Marks	Time(hrs.)
Theory / * Computer based	Written paper based on the entire syllabus.	65	2
	* Computer based assessment in the college premises.		
Oral	Questions based on the entire syllabus.	25	As applicable
Practical	Performance of the practical assigned during the examination and the output / results obtained.	25	2
Oral & Practical	Project based courses - Performance of the practical assigned during the examination and the output / results obtained. Based on the practical performed during the examination and on the entire syllabus.	As per the scheme	2

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Program: Information Technology **T.Y B. Tech** **Semester: V**

Course: Artificial Intelligence (DJS22ITC501)
Course: Artificial Intelligence Lab (DJS22ITL501)

Pre-requisite: Knowledge of Programming Language and Algorithms

Course Objectives:
1. Provide the basic ideas and techniques underlying the design of intelligent systems.
2. Impart the knowledge of various search techniques for problem solving.
3. Learn knowledge representation, planning and provide the knowledge to deal with uncertain and incomplete information.

Course Outcomes: On successful completion of this course, student should be able to:
1. Understand the fundamentals of artificial intelligence systems.
2. Apply various AI approaches to knowledge intensive problem solving, reasoning, planning and uncertainty.
3. Develop the AI applications in real world scenarios.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Artificial Intelligence:** Introduction, History of Artificial Intelligence, Intelligent Systems: Categorization of Intelligent System, Components of AI Program, Foundations of AI **Agents and Environments:** Concept of rationality, Nature of environment, Structure of Agents, Types of Agents, PEAS representation for an Agent	**05**
2	**Problem Solving:** Problem Solving Agent, Formulating Problems, Example Problems. **Search Methods:** **Uninformed Search:** Breadth First Search (BFS), Depth First Search (DFS), Depth Limited Search, Depth First Iterative Deepening (DFID) **Informed Search:** Greedy Best First Search, A* Search, Memory bounded heuristic Search. **Local Search Algorithms and Optimization Problems:** Hill Climbing search, Simulated Annealing, Genetic algorithms, Ant Colony Optimization **Adversarial Search:** Game Playing, The Minimax algorithm, Alpha-Beta Pruning	**12**
3	**Knowledge Representation and Reasoning:** Knowledge based Agents, The Wumpus World, Propositional Logic, First Order Logic, Inference in FOL, Conjunctive Normal Form, Forward Chaining, Backward Chaining, Unification, Resolution, Logic Programming (PROLOG), Semantic networks **Uncertain Knowledge and Reasoning:** Representing knowledge in an uncertain domain, The semantics of Bayesian Belief Network, Inference in Belief Network	**07**
4	**Planning:** The planning problem, Planning with state space search, Planning graphs, Partial order planning, Hierarchical planning	**04**
5	**Learning:** Types of Learning, Inductive Learning **Artificial Neural Networks:** McCulloh Pitts Model, Perceptron, Feed Forward Network, Backpropagation Algorithm, Self-Organizing Map	**07**
6	**Expert System:** Introduction, Phases in building Expert Systems, ES Architecture, Case Study on MYCIN Rule based system **Advanced topic:** Responsible AI , Introduction to Generative AI, Explainable AI.	**04**

List of Laboratory Experiments:
1. Select a problem statement relevant to AI.
   i) Identify the problem
   ii) PEAS Description
   iii) Problem formulation
2. Identify and analyze Uninformed Search Algorithm to solve the problem. Implement BFS/DFS search algorithms to reach goal state.

3. Implement DFID search algorithms to reach goal state.
4. Identify and analyze Informed Search Algorithm to solve the problem. Implement A* search algorithm to reach goal state
5. Program to implement Local Search algorithm: Hill Climbing search
6. Program on Genetic Algorithm to solve an optimization problem in AI.
7. Program to implement learning: Perceptron Learning / Backpropagation Algorithm.
8. The laboratory will emphasize the use of PROLOG.
   (For example, Program to implement Family Tree in Prolog)
9. Implementation on any AI game: Wumpus world, Tic-tac-toe, 8-Queens Problem
10. Case study of an AI Application.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept

Books Recommended:

Text books:

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach", 2nd Edition, Pearson Education,1995.
2. Saroj Kaushik, "Artificial Intelligence", 2nd Edition, Cengage Learning, 2011.
3. George F Luger, "Artificial Intelligence", 4th Edition, Low Price Edition, Pearson Education, 2005.
4. Deepak Khemani, "A First Course in Artificial Intelligence", 1st Edition, McGraw Hill Education (India), 2013.

Reference Books:

1. Ivan Bratko, "PROLOG Programming for Artificial Intelligence", 3rd Edition, Pearson Education, 2014.
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", 3rd Edition, McGraw Hill Education (India), 2010
3. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", 1st Edition, Addison Wesley, N.Y., 1989.
4. Hagan, Demuth, Beale, "Neural Network Design", 2nd Edition, CENGAGE Learning, India Edition, 2004.
5. Patrick Henry Winston, "Artificial Intelligence", 3rd Edition Addison-Wesley, 1992.
6. Han Kamber, "Data Mining Concepts and Techniques", 3rd Edition, Morgann Kaufmann Publishers, 2011.
7. N.P.Padhy, "Artificial Intelligence and Intelligent Systems", 1st Edition, Oxford University Press, 2005.

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Program: Information Technology **T.Y B. Tech** **Semester: V**

Course: Advanced Data Structures (DJS22ITC502)
Course: Advanced Data Structures Lab (DJS22ITL502)

Pre-requisite: Knowledge of - Data Structures and any programming language like C or JAVA

Course Objectives: This course emphasizes recent evolutions of data structures apt for new paradigms of computation and applications to various domains of computer science. The course also introduces techniques such as amortized complexity analysis to the students.

Course Outcomes: On successful completion of this course, the student should be able to:
1. Carry out amortized Analysis of algorithms.
2. Solve a problem using appropriate data structure.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Analysis of Data Structures:** Amortized Complexity- Aggregate Method, Accounting Method, Potential Method **Data Structures for String:** Tries and Compressed Tries, Suffix Tree and Suffix array, String Searching with application.	06
2	**Balanced Search Tree:** Height Balance and Weight Balance Trees, Red-Black Tree, Splay Tree, Skip List, Randomized BST, Tango Tree with application.	08
3	**Heap and Operations:** Heap ordered Tree, Leftist Heap, Skew Heap, tournament Tree, Binomial Heap, Fibonacci Heaps, Pairing Heap, Double Ended Heap, Multidimensional Heaps, Van Emde Boas Priority Queues, Treap with application.	06
4	**External Memory and Distributed Data Structures:** B Tree, B+ Tree, B* Tree, (a, b) Tree, Counted B Tree, Buffer Tree, Fenwick Tree with application, Distributed Trees, Skip Graphs.	07
5	**Spatial Data Structures:** Interval, Segment, Range, Priority Search Tree, KD Tree, Quad Tree, OCTree, R Tree with application.	06
6	**Hash Tables:** Universal Families of Hash Functions, Perfect Hash Functions, Cuckoo Hashing, Probabilistic Data Structures: Bloom filters, Count-Min Sketch, HyperLogLog. Locality Sensitive Hashing, Hash Tree (Merkle Tree) with application.	06

List of Laboratory Experiments: (Any 10)

Minimum 1 experiment based on each module numbered wherein students need to select a problem statement of relevance and provide the implementable solution by selecting appropriate advanced data structures. Also perform analysis of it.

1. Experiment on Amortized Analysis
2. Experiment on Balanced Search Trees.
3. Experiment on Heap data structure.
4. Experiment on String data structure.
5. Experiment on External Memory and Distributed Data Structures.
6. Experiment on Spatial data structure.
7. Experiment on Hash Tables.

Books Recommended:

Text books:

1. Peter Brass, “Advanced Data Structures”, 1st Edition, Cambridge University Press, 2008.
2. Suman Saha, Shailendra Shukla, “Advanced Data Structures Theory and Applications”, 1st Edition, CRC Press and Taylor & Francis, 2019.

Reference Books:

1. Dinesh Mehta and Sartaj Sahni, "Handbook of Data Structures and Applications", 1st Edition, Chapman & Hall/CRC, 2005.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, "Introduction to Algorithms", 3rd Edition, The MIT Press, 2009.
3. Daniel R. Page, "Advanced Data Structures: An Introduction to Data Structures and Algorithms", Kindle Edition, 2020.

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Program: Information Technology **T.Y B. Tech Semester: V**

Course: Data Warehousing and Mining (DJS22ITC503)
Course: Data Warehousing and Mining Laboratory (DJS22ITL503)

Pre-requisite: Basic database concepts, Concepts of algorithm design and analysis

Course Objectives: This course emphasizes data management using data warehousing and data mining concepts for decision-making in an organization. Data mining is introduced as an exploratory methodology to gather data coming from various sources and preprocess it for mining.

Course Outcomes: On successful completion of this course, student should be able to:
1. Design data warehouse models using dimension-modeling techniques.
2. Analyze the data by applying Online Analytical Processing (OLAP) operations for strategic decisions.
3. Apply preprocessing techniques for the given raw data.
4. Apply appropriate data mining techniques on data sets to retrieve relevant information.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Data Warehouse and Dimensional modelling:** Introduction to Strategic Information, need for Strategic Information, Features of Data Warehouse, Data warehouse versus Data Marts, Data warehouse versus Data Lake, Top-down versus Bottom-up approach. Data warehouse architecture, E-R modelling versus Dimensional Modelling, Information Package Diagram, STAR schema, STAR schema keys, Snowflake Schema, Fact Constellation Schema, Factless Fact tables, Update to the dimension tables, Aggregate fact tables.	**08**
2	**ETL Process and OLAP:** Major steps in ETL process, Data extraction: Techniques, Data transformation: Basic tasks, Major transformation types, Data Loading: Applying Data, OLTP Vs OLAP, OLAP definition, Dimensional Analysis, Hypercubes, OLAP operations: Drill down, Roll up, Slice, Dice and Rotation, OLAP models: MOLAP, ROLAP, HOLAP.	**06**
3	**Introduction to Data Mining, Data Exploration and Preprocessing:** Data Mining Task and Techniques, KDD process, Issues in Data Mining, Applications of Data Mining, Data Exploration: Types of Attributes, Statistical Description of Data, Data Visualization, Measuring data similarity and dissimilarity. Data Preprocessing: Major tasks in preprocessing, Data Cleaning: Missing values, Noisy data; Data Integration: Entity Identification Problem, Redundancy and Correlation Analysis, Tuple Duplication, Data Value Conflict Detection and Resolution; Data Reduction: Attribute subset selection, Histograms, Clustering and Sampling; Data Transformation & Data Discretization: Data Transformation by Normalization, Discretization by Binning, Discretization by Histogram Analysis	**06**
4	**Classification and Clustering:** **Classification** Basic Concepts of classification, Decision Tree Induction, Attribute Selection Measures using Information Gain, Tree pruning, Bayes Classification Methods: Bayes' Theorem, Naïve Bayesian Classification, Model Evaluation: Metrics for Evaluating Classifier Performance, Holdout Method and Random Subsampling, Cross Validation, Bootstrap, Improving Classification Accuracy: Ensemble classification, Bagging, Boosting and AdaBoost, Random Forests **Clustering:** Cluster Analysis and Requirements of Cluster Analysis, Partitioning Methods: k-Means, k-Medoids, Hierarchical Methods: Agglomerative, Divisive, Evaluation of Clustering: Assessing Clustering Tendency, Determining Number of Clusters and Measuring cluster quality: Intrinsic and Extrinsic methods	**08**
5	**Mining Frequent Patterns and Association Rules:** Market Basket Analysis, Frequent Item sets, Closed Item sets, and Association Rule Frequent Item set Mining Methods: Apriori Algorithm, Association Rule Generation, FP growth	**05**

6	**Spatial and Web Mining:** Spatial Data, Spatial Vs. Classical Data Mining, Spatial Data Structures, Mining Spatial Association and Co-Location Patterns, Spatial Clustering Techniques: CLARANS Extension **Web Mining**: Web Content Mining, Web Structure Mining, Web Usage mining, Applications of Web Mining	**06**

List of Laboratory Experiments:

1. To visualize the data for a data warehouse using the Business Intelligence tool.
2. Build Data Warehouse/Data Mart for a given problem statement.
    i. Identifying the source tables and populating sample data
    ii. Making information package diagram
    iii. Design dimensional data model i.e. Star schema, Snowflake schema and Fact Constellation schema (if applicable)
3. Perform data Pre-processing task on your dataset.
4. To perform various OLAP operations such as slice, dice, drilldown, rollup, pivot
5. Implementation of Classification algorithm
    i. Using Decision Tree ID3
    ii. Naïve Bayes algorithm
6. Implementation of Clustering algorithm
    i. K-means
    ii. Hierarchical clustering (single/complete/average)
    iii. DBScan
7. Implementation of Association Rule Mining algorithm
    i. Apriori algorithm
    ii. FP Tree algorithm
8. Demonstrate performing Classification, Clustering, Association algorithm on data sets using data mining tool (WEKA, R tool, XL Miner, etc.)
9. Implementation of page rank algorithm
10. Implementation of HITS algorithm.
11. Implementation of Spatial Clustering Algorithm- CLARANS Extensions.
12. Case study on recent data mining applications

Books Recommended:

1. Paulraj Ponniah, "Data Warehousing: Fundamentals for IT Professionals", 2nd Edition, Wiley India, 2013.
2. Theraja Reema, "Data Warehousing", 1st Edition, Oxford University Press, 2009.
3. Han, Kamber, "Data Mining Concepts and Techniques", 3rd Edition, Morgan Kaufmann, 2012.
4. P. N. Tan, M. Steinbach, Vipin Kumar, "Introduction to Data Mining", 2nd Edition, Pearson Education, 2018.
5. H. Dunham, "Data Mining: Introductory and Advanced Topics", 1st Edition, Pearson Education, 2006.

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Program: Information Technology **T.Y B. Tech Semester: V**

Course: Cryptography and Network Security (DJS22ITC504)
Course: Cryptography and Network Security Lab (DJS22ITL504)

Pre-requisite: Knowledge of -

1. Computer Networks
2. Basic concepts of OSI Layer
3. General ease with algorithms, elementary number theory and discrete probability

Course Objectives: This course intends to provide a sound foundation in cryptography. Students are introduced to basic cryptographic techniques like encryption, hashing and message authentication, in the "private key" and "public key" settings, with a focus on mathematical definitions of security. The course will also explore the current practices & challenges in network security and use cryptographic primitives in higher-level network security protocols.

Course Outcomes: On successful completion of this course, student should be able to:

1. Design secure system using appropriate security mechanism.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction:** Security goals-CIA, the OSI security architecture, Threats, Attacks (Active, passive) on Information and vulnerability, System Security Threats, Vulnerability assessment and penetration testing. Classical Encryption techniques (Symmetric cipher model, mono-alphabetic and poly alphabetic substitution ciphers, transposition techniques: keyed and keyless transposition ciphers), Cryptography in the age of quantum computers, introduction to quantum cryptography.	**08**
2	**Symmetric Block Ciphers:** Data Encryption Standard-Block cipher principles-block cipher modes of operation- Advanced Encryption Standard (AES)-Triple DES	**07**
3	**Public key cryptography:** Principles of public key cryptosystems-knapsack cryptosystem, The RSA algorithm, El-Gamal Algorithm, Rabin cryptosystems.	**07**
4	**Cryptographic Hashes, Message Digests:** Authentication requirement – Authentication function, Types of Authentications, MAC – Hash function – Security of hash function and MAC –MD5 – SHA – HMAC – CMAC, hash chain and hash tree (Merkletree)	**05**
5	**Authentication Protocols:** Needham Schroeder Authentication protocol, Otway Rees, Authentication Applications, Kerberos, Key Management, challenge response protocols, Diffie Hellman Key exchange, station to station key management, Digital Certificate: X.509 (EC), PKI Digital Signature Schemes – RSA, DSS, ECC.	**06**
6	**Network Security:** Overview of OSI Layer attacks, Firewalls, Intrusion Detection Systems: Host Based and Network Based IDS. Network Security Model, SSL, TLS, IPSEC: AH, ESP, Secure Email: PGP and S/MIME	**06**

List of Laboratory Experiments: (Any Ten)

1. Design and Implementation of a product cipher using Substitution and Transposition ciphers.
2. Analysis of Block ciphers.
3. Implementation and analysis of public key cryptography.
4. Implementation and analysis of Digital signature scheme.
5. Implementation of Diffie-Hellman Key exchange algorithm.
6. For varying message sizes, test integrity of message using MD-5, SHA-1, and analyse the performance of the two protocols. Use crypt APIs.
7. Implementation of authentication protocols.
8. Explore the GPG tool of linux to implement email security.
9. Download and install nmap. Use it with different options to scan open ports, perform OS fingerprinting, do a ping scan, tcp portscan, udp port scan, etc.

10. Detect ARP spoofing using nmap and/or opensource tool ARPWATCH and Wireshark.
11. Simulate DOS attack using Hping and other tools.
12. Set up IPSEC under LINUX.
13. Set up Snort (IDS) and study the logs.
14. Study experiment: scenario based or tools

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Books Recommended:

Textbooks:

1. Behrouz A. Ferouzan, "Cryptography & Network Security", 3rd Edition, Tata McGraw Hill, Nov 2015.
2. William Stallings, "Cryptography and Network Security, Principles and Practice", 7th Edition, Pearson Education, 2017.
3. Atul Kahate, "Cryptography and Network Security", 3rd Edition, Tata McGraw Hill, 2017.
4. Bernard Menezes, "Cryptography & Network Security", 5th Edition, Cengage Learning, 2010.

Reference Books:

1. Bruce Schneier, "Applied Cryptography, Protocols Algorithms and Source Code in C", 2nd Edition, Wiley, 2006.
2. Mark Stamp, "Information Security Principles and Practice", 2nd Edition, Wiley, 2011.

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Program: Information Technology **T.Y B. Tech Semester: V**

Course: Microcontrollers and Embedded Systems (DJS22ITC5011)
Course: Microcontrollers and Embedded Systems Laboratory (DJS22ITL5011)

Pre-requisite: Knowledge of Microprocessors and Assembly Language Programming

Course Objectives: The objective of this course is to provide a comprehensive introduction to the architecture and assembly language programming of 8051 and ARM 7 microcontrollers. It provides an overview of the difference between microprocessors and microcontrollers. The course familiarizes students with different peripheral devices & their interfacing to 8051, memory organization, interrupts, instruction set, addressing modes of both 8051 and ARM 7 microcontroller. The student will implement middle level programming and interfacing concepts in 8051 and write assembly language program in 8051 and ARM 7 for various applications.

Course Outcomes: On successful completion of this course, student should be able to:
1. Describe the architecture of 8051 and ARM 7 microcontrollers, write assembly program and design interfacing for 8051 microcontrollers.
2. Prioritize tasks in a real-time system using various scheduling algorithms.
3. Identify the requirements for real world problems and develop solutions using embedded boards like Arduino, Raspberry Pi, ARM Cortex, Intel Galileo etc.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**The Microcontroller Architecture and Programming of 8051:** Introduction to 8051 Microcontroller, Architecture, Pin configuration, Memory organization, Input /Output Ports, Counter and Timers, Serial communication, Interrupts. Instruction set, addressing modes, Development tools, Assembler Directives, Programming based on Arithmetic & Logical Operations, I/O parallel and serial ports, Timers & Counters, and ISR.	**08**
2	**Interfacing with 8051 Microcontroller:** Interfacing ADC, DAC, Stepper motor, LCD, KBD matrix, 8255 PPI	**05**
3	**ARM 7 Architecture:** Architectural Inheritance, Data Path Design, Flag Register / CPSR, SPSR, Mode Bits, Condition Flags, Programmer's Model, Pipelining, Operating Modes: User, FIQ, IRQ, Supervisor, Abort, Undefined, System mode	**06**
4	**ARM 7 Interrupts and Programming:** ARM Development tools, ARM 7 Interrupts: Reset, Undefined, SWI, Prefetch Abort, Data Abort, IRQ, FIQ; Multiple Exceptions, ARM 7 Addressing Modes: Immediate, Register, Direct, and Indirect; Instruction set: Branch, Data Movement, Load and Store, Arithmetic, Multiply, Long Multiply, Logical, Compare, Stack operations; Writing simple assembly language programs	**10**
5	**Real Time Operating System:** Basics of RTOS, Real-time concepts, Hard Real Time System, Soft Real Time System, Firm Real Time System, Differences between general purpose OS & RTOS, Basic Architecture of RTOS, Features of RTOS, Scheduling algorithms in RTOS - Clock Driven, Weighted Round Robin, Priority Scheduling (Earliest Deadline First, Least Slack Time, Rate Monotonic Scheduling), Priority Inversion Problem, Solutions to Priority Inversion – Non Blocking Critical Section, Priority Ceiling, Priority Inheritance, Interrupt management in RTOS environment, Memory management, Selecting a Real Time Operating System, RTOS comparative study	**07**
6	**Introduction to Embedded target boards:** Introduction to Arduino, Raspberry Pi, ARM Cortex, Intel Galileo etc. Open-source prototyping platforms. Basic Arduino programming; Extended Arduino libraries; Arduino-based Internet communication; Raspberry pi; ARM Cortex Processors; Intel Galileo boards; Sensors and Interfacing: Temperature, Pressure, Humidity	**03**

List of Laboratory Experiments: ***(Any 4 from 8051, any 4 from ARM, 2 based on Arduino, Raspberry Pi)***
1. Data Transfer - Block move, Exchange.
2. Sorting, Finding largest element in an array.
3. Arithmetic Instructions - Addition/subtraction, multiplication and division, Boolean & Logical Instructions (Bit manipulations).

4. Conditional CALL & RETURN.
5. Simple Calculator using 6 digits seven segment displays and Hex Keyboard interface to 8051.
6. Alphanumeric LCD panel and Hex keypad input interface to 8051.
7. External ADC and Temperature control interface to 8051.
8. Data Transfer (16-bit, 32-bit, 64 bit).
9. One's Complement, Addition, Subtraction, Bit Shifting.
10. Largest and Smallest of 2, 3 nos.
11. Loops (Series addition, largest, smallest, etc.).
12. Multiplication and Division programs.
13. Programs on Stacks.
14. Any practical application using Arduino.
15. Any practical application using Raspberry Pi.
16. Case Study on RTOS.

Books Recommended:

Textbooks:

1. M. A. Mazidi, J. G. Mazidi, R. D., McKinlay, "The 8051 microcontroller & Embedded systems Using Assembly and C", 3rd Edition, Pearson, 2013.
2. Dr. K.V. K. K. Prasad., "Embedded / Real–Time Systems: Concepts, Design & Programming Black Book", Reprint Edition, Dreamtech Press, 2013.
3. Shibu K. V., "Introduction to Embedded Systems", 2nd Edition, McGraw Hill, 2017.
4. Massimo Banzi, "Getting Started with Arduino", 2nd Edition, O'reilly, 2011.
5. Simon Monk, "Raspberry Pi Cookbok", 3rd Edition, O'reilly, 2019.

Reference Books:

1. Laya B. Das, "Embedded systems an integrated approach", 3rd Edition, Pearson, 2013.
2. Steve Furber, "ARM System on chip Architecture", 2nd Edition, Pearson, 2001.
3. Raj Kamal, "Embedded Systems", 3rd Edition, McGraw Hill, 2017.

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Program: Information Technology **T.Y B. Tech Semester: V**

Course: Computer Graphics (DJS22ITC5012)
Course: Computer Graphics Laboratory (DJS22ITL5012)

Pre-requisite: Basic Mathematics, C Programming, Java

Course Objectives: The course intends to introduce the students to fundamental knowledge and basic technical competence in the field of computer graphics. The course will introduce the basic concepts of Computer graphics. The course will also acquaint the student with algorithms for generating and rendering graphical models, and mathematics for geometrical transformations. The course will also enable students to apply various techniques of projection, shading, illumination and lighting to graphical models.

Course Outcomes: On successful completion of this course, student should be able to:
1. Implement various algorithms to generate lines, circles, curves, fractals, polygons and color them.
2. Apply 2D and 3D Transformations, viewing and projections on a given object.
3. Understand the concept of color models, lighting, shading and hidden surface elimination.
4. Design an animation sequence.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Computer graphics and Output Primitives:** Graphics primitives- pixel, resolution, aspect ratio, frame buffer, refresh rates, Display Devices, Bitmap and Vector based graphics, Overview of Coordinate system. Scan Conversion of - point, line using Digital differential analyser & Bresenham's algorithm, circle using midpoint approach and Bresenham. **Polygons:** Concave, Convex, Inside/Outside Test **Area Filling:** Scan line Polygon Fill Algorithm, Boundary Fill and Flood Fill algorithm	**08**
2	**Two Dimensional Transformations:** Basic Geometrical 2D transformations- Translation, Rotation, Scaling, Reflection, Shear, their homogeneous Matrix representation, and Composite transformation. **Three Dimensional Transformations:** Translation, Rotation, Scaling, Rotation about an arbitrary axis	**07**
3	**Viewing Transformations and Projections:** Introduction, Viewing Pipeline, View Coordinate reference frame, Window to Viewport Transformation, Point Clipping, Line clipping: Cohen Sutherland Algorithm, Liang Barsky Algorithms, Polygon Clipping: Sutherland Hodgeman Polygon Clipping and Weiler Atherton, Text Clipping. Three-Dimensional Viewing Pipeline, Viewing Transformation, Projections: Parallel (Oblique and Orthographic), Perspective (one Point, two point and three point)	**07**
4	**Light, Color, Shading and Hidden Surfaces:** Properties of Light, Color Models - CIE chromaticity diagram, RGB, HSV, CMY **Illumination Models:** Ambient Light, Diffuse reflection, specular reflection, Phong Model, combined diffuse and specular reflections with multiple light sources, Warn Model **Shading Algorithms:** Introduction to Rendering, Halftone, Gouraud and Phong Shading **Hidden Surfaces:** Introduction, Back face detection and removal, Algorithms: z buffer, Painter's algorithm, Area Subdivision (Warnock)	**08**
5	**Curves:** Introduction to curves, interpolation and approximation, Blending Function, Bezier and B-spline curves **Fractals:** Introduction, Classification, Fractal Generation- Snowflake, Sierpinski Gasket, Koch Curve, Cantor Middle-Thirds Set, Hilbert Curve, Applications of Fractals.	**05**
6	**Introduction to Animation:** Key Frame Animation, Animation Sequence, Motion Control Methods, Morphing, Warping (only Mesh Warping).	**04**

List of Laboratory Experiments:
1. Implementation of Line Drawing algorithms: DDA, Bresenham and using them generate line with different styles like dotted, dashed, centered and thick line.
2. Implementation of Circle generation algorithms and using it generate concentric circles.
3. Implementation of Area Filling Algorithm: Boundary Fill, Flood Fill and Scan line, Polygon Fill.

4. Generate a Bezier curve for n control points.
5. Program for performing two dimensional transformations.
6. Implement Line clipping algorithms.
7. Implementation of Polygon Clipping Algorithm
8. Generate a snowflake using fractals.
9. Implement Illumination and shading apply on sphere using two light sources in OpenGL
10. Develop a scene in Unity that includes:
    a. A cube, plane, and sphere, apply transformations on the 3 game objects.
    b. Add a video and audio source.

Books Recommended:

Text books:

1. Donald Hearn and M. Pauline Baker, "Computer Graphics C Version", 2nd Edition, Pearson Education, 2002.
2. James D. Foley, Andries van Dam, Steven K Feiner, John F. Hughes, "Computer Graphics Principles and Practice in C", 2nd Edition, Pearson Publication, 1995.
3. Rajesh K. Maurya, "Computer Graphics", 3rd Edition, Wiley India Publication, 2016.

Reference Books:

1. Donald Hearn and M. Pauline Baker, "Computer Graphics with Open GL", 4th Edition, Pearson Education, 2011.
2. Steven Harrington, "Computer Graphics", 2nd Edition, McGraw Hill, 1983.
3. Rogers, "Procedural Elements of Computer Graphics", 2nd Edition, Tata McGraw Hill, 2011.
4. F.S. Hill, Stephen M. Kelley, "Computer Graphics using Open GL", 2nd Edition, Prentice Hall, 2001.
5. Samit Bhattacharya, "Computer Graphics", 1st Edition, Oxford Publication, 2015.

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Program: Information Technology **T.Y B. Tech Semester: V**

Course: Statistical Analysis (DJS22ITC5013)
Course: Statistical Analysis Laboratory (DJS22ITL5013)

Pre-requisite: Basic knowledge of statistics

Course Objectives: The objective of this course is to make the learner explore statistical concepts, which include probability, probability distributions, sampling, estimation, hypothesis testing, regression, correlation analysis and multiple regression.

Course Outcomes: On successful completion of this course, student should be able to:
1. Interpret the data using Descriptive Statistics.
2. Perform Test of Hypothesis for independence and appropriateness of distribution using various statistical techniques.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Statistical Analysis:** Introduction, Meaning of Statistics, The Scientific Method, Characteristics of Statistics, Data Measurement, Populations and Samples, Sampling Techniques, Census and Sampling Method, Parameter and Statistic, Independent and Dependent Variables, Examining Relationships.	**02**
2	**Modeling Data:** Types of Data, Data Transformation, Measures of Central Tendency (mean, median. Mode), Measures of Variability (range, IQR, variance, standard deviation), Measures of Shape (skewness, coefficient of skewness), Relationship between Mean, Median, Mode, Kurtosis, Estimator and Estimate, Standard Error, Sampling distribution of the sample means/proportion.	**04**
3	**Making Inference About Population Parameters (1 population and 2 population):** Large sample estimation of the population parameters, Point and Interval Estimation of the population proportion, Estimating population mean using z statistic, estimating population mean using t statistic, Estimating population proportion, Estimating population variance	**08**
4	**Hypothesis Testing (1 population and 2 population):** Introduction, Null and Alternative Hypothesis, Type I and Type II Error, The Procedure of Hypothesis Testing, Hypothesis Testing of a Population Mean using z statistic, t statistic, Testing Hypothesis about a proportion, Testing hypothesis about a variance.	**08**
5	**Analysis of Variance:** Introduction to Design of Experiments, One-way ANOVA, The Randomized Block Design, Two-way ANOVA, MANOVA (one way and two day).	**09**
6	**Non-Parametric Statistical Tests:** Chi-square Goodness-of-Fit Test, Chi-Square as a test of independence, Runs Test, Mann-Whitney U Test, Wilcoxon Matched-Pairs Signed Rank Test for small and large sample.	**08**

List of Laboratory Experiments:
Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.
1. To explore descriptive statistics.
2. To estimate confidence interval for mean, population proportion and variance (Single Population).
3. To implement single population tests for mean, proportion and variance.
4. To implement two population tests for mean, proportion.
5. To implement two population tests for variance.
6. To implement Chi-square test for independence and goodness of fit.
7. To implement ANOVA.
8. To implement MANOVA.
9. To perform Mann-Whitney U Test.
10. To perform a Wilcoxon test.

Books Recommended:

Text books:

1. Gupta, S. P, "Statistical Methods", 46th Edition, Sultan Chand & Sons, 2012.
2. Ken Black, "Business Statistics for Contemporary Decision making", 6th Edition, Wiley Publication, 2011.
3. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, "An Introduction to Statistical learning with Applications in R.", 3rd Edition, Springer Science Business Media, New York, 2013.

Reference Books:

1. D.C. Montgomery and G.C. Runger, "Applied Statistics and Probability for Engineers", 7th Edition, Wiley, 2020.
2. Agresti, A., "An Introduction to Categorical Data Analysis", 3rd Edition, John Wiley & sons, 2012.
3. Hastie T, Tibshirani, R, & Friedman, J., "The Element of Statistical Learning, Data mining, Inference and Prediction",3rd Edition, New York: Springer Series in Statistics, 2011.

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Program: Information Technology **T.Y B. Tech Semester: V**

Course: Professional and Business Communication Laboratory (DJS22IHL)

Pre-requisite: Basic course in Effective Communication Skills

Course Objectives:
1. To inculcate professional and ethical attitude at the workplace.
2. To enhance communication and interpersonal skills.
3. To develop effective employability skills.
4. To hone written skills for technical documentation.

Course Outcomes: On successful completion of this course, student should be able to:
1. Prepare technical documents using appropriate style, format, and language.
2. Use employability skills to optimize career opportunities.
3. Employ storytelling techniques in corporate situations.
4. Conduct effective meetings and document the process.
5. Demonstrate interpersonal skills in professional and personal situations.
6. Describe cultural differences, etiquettes, and the concept of professional ethics.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Unit 1: Technical Writing** **Report Writing:** Types of reports, Basic structure of a report, collection of data through questionnaires, survey analysis, language and style in reports **Business Proposal Writing:** Types of business proposals, format of proposal, language and style, presentation of proposal **Plagiarism:** Types of plagiarism, consequences of plagiarism	**06**
2	**Unit 2: Employment Skills** **Group Discussion:** Purpose of a GD, types of GD, criteria for evaluating GD, Dos and Don'ts of GD **Resume Writing:** Types of resumes, structure, content and formatting of resume **Interview Skills:** Types and modes of interview, Preparation for interview, Dos and Don'ts of interview, frequently asked questions during interview **Presentation Skills:** Presentation strategies, overcoming stage fear, techniques to prepare effective PowerPoint presentation	**08**
3	**Unit 3: Corporate Story Telling** **Basics of storytelling:** Setting, characters, plot, crisis, climax, resolution, Benefits of storytelling **Types of stories:** Elevator pitch, product stories, event stories, stories in presentations, storytelling in SOP's and interviews, storytelling to manage conflict or to motivate **Storytelling techniques:** Narration using verbal and non-verbal communication, Analysis of storytelling strategies of corporate master storytellers	**03**
4	**Unit 4: Meetings and Documentation** **Planning and preparation for meetings:** Planning layout of meetings, arranging logistics, defining roles and responsibilities. **Strategies for conducting effective meetings:** Follow the agenda**,** record discussion, observe meeting decorum. **Documentation:** Draft notice, agenda and minutes of meeting **Business meeting etiquettes: V**erbal and non-verbal aspects of etiquettes.	**02**
5	**Unit 5: Introduction to Interpersonal Skills** **Emotional Intelligence:** Definition, difference between IQ and EQ, how to develop EQ **Leadership:** Types of leadership, leadership styles, case studies **Team Building:** Difference between group and team, importance of teamwork, strategies to be a good team player. **Time Management:** Importance of time management, cultural views of time, 80/20 rule, time wasters, setting priorities and goals, **Conflict Management:** Types of conflicts, strategies to manage conflict, case studies	**05**

6	**Unit 6: Cross-cultural communication and Professional ethics** **Communication across cultures**: Understanding cultures and developing sensitivity towards cultural differences. **Corporate etiquettes**: Telephone, dining, cubicle etiquette, etc. **Professional ethics:** Effective work habits, accountability, integrity and excellence	**02**

List of Laboratory Experiments:
Laboratory (conducted batch wise) will comprise of activities and assignments based on the syllabus.

Books Recommended:

1. Fred Luthans, "Organizational Behavior", 12th Edition, McGraw Hill, 2010.
2. Lesiker and Petit, "Report Writing for Business", 10th Edition, McGraw Hill, 1997.
3. Huckin and Olsen, "Technical Writing and Professional Communication", 2nd Edition, McGraw Hill,1990.
4. Wallace and Masters, "Personal Development for Life and Work", 12th Edition, Thomson Learning, 2015.
5. Heta Murphy, "Effective Business Communication", 7th Edition, Mc Graw Hill, 2017.
6. Sharma R.C. and Krishna Mohan, "Business Correspondence and Report Writing", 6th Edition, Tata McGraw-Hill Education, 2020.
7. Ghosh, B. N., "Managing Soft Skills for Personality Development", 4th Edition, Tata McGraw Hill. Lehman, 2012.
8. Bell, Smith, "Management Communication", 3rd Edition, Wiley India Edition, 2014.
9. Dr. Alex, K., "Soft Skills", 3rd Edition, S Chand and Company, 2009.
10. Subramaniam, R., "Professional Ethics", 2nd Edition, Oxford University Press, 2017.
11. Sandeep Das, "How Business Story Telling Works: Increase Your Influence and Impact", 1st Edition, Penguin Random House India Pvt. Ltd, 2023.

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Program: Information Technology **T.Y B. Tech Semester: V**

Course: Innovative ProductDevelopment III (DJS22ILL1)

Pre-requisite: NA

Course Objectives:

1. To acquaint the students with the process of identifying the need (considering a societal requirement) and ensuring that a solution is found out to address the same by designing and developing an innovative product.
2. To familiarize the students with the process of designing and developing a product, while they work as part of a team.
3. To acquaint the students with the process of applying basic engineering fundamentals, so as to attempt at the design and development of a successful value added product.
4. To inculcate the basic concepts of entrepreneurship and the process of self-learning and research required to conceptualize and create a successful product.

Course Outcomes: On successful completion of this course, student should be able to:

1. Identify the requirement for a product based on societal/research needs.
2. Apply knowledge and skills required to solve a societal need by conceptualizing a product, especially while working in a team.
3. Use standard norms of engineering concepts/practices in the design and development of an innovative product.
4. Draw proper inferences through theoretical/ experimental/simulations and analyses the impact of the proposed method of design and development of the product.
5. Develop interpersonal skills, while working as a member of the team or as the leader.
6. Demonstrate capabilities of self-learning as part of the team, leading to life-long learning, which could eventually prepare themselves to be successful entrepreneurs.
7. Demonstrate product/project management principles during the design and development work and also excel in written (Technical paper preparation) as well as oral communication.

Guidelines for the proposed product design and development:

- Students shall convert the solution designed in semester 3 and 4 into a working model, using various components drawn from their domain as well as related interdisciplinary areas.
- The working model is to be validated with proper justification and the report is to be compiled in a standard format and submitted to the department. Efforts are to be made by the students to try and publish the extended technical paper, either in the institute journal, “Techno Focus: Journal for Budding Engineers” or at a suitable publication, approved by the department research committee/ Head of the department.
- Faculty supervisor may provide inputs to students during the entire span of the activity, spread over 2 semesters, wherein the main focus shall be on self-learning.
- A record in the form of an activity log-book is to be prepared by each team, wherein the team can record weekly progress of work. The guide/supervisor should verify the recorded notes/comments and approve the same on a weekly basis.
- The focus should be on self-learning, capability to design and innovate new products as well as on developing the ability to address societal problems. Advancement of entrepreneurial capabilities and quality development of the students through the year long course should ensure that the design and development of a product of appropriate level and quality is carried out, spread over two semesters, i.e. during the semesters V and VI.

Guidelines for Assessment of the work:

- The review/ progress monitoring committee shall be constituted by the Head of the Department. The progress of design and development of the product is to be evaluated on a continuous basis, holding a minimum of two reviews in each semester.
- In the continuous assessment, focus shall also be on each individual student’s contribution to the team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.
- Oral examination should be conducted by Internal and External examiners. Students have to give presentation and demonstration on their working model
- The distribution of marks for term work shall be as follows:
    1. Marks awarded by the supervisor based on log-book: 10
    2. Marks awarded by review committee: 10
    3. Quality of the write-up: 05

The overall work done by the team shall be assessed based on the following criteria;

1. Quality of survey/ need identification of the product.
2. Clarity of Problem definition (design and development) based on need.
3. Innovativeness in the proposed design.
4. Feasibility of the proposed design and selection of the best solution.
5. Cost effectiveness of the product.
6. Societal impact of the product.
7. Functioning of the working model as per stated requirements.
8. Effective use of standard engineering norms.
9. Contribution of each individual as a member or the team leader.
10. Clarity on the write-up and the technical paper prepared.

- The semester reviews (V and VI) may be based on relevant points listed above, as applicable.

Guidelines for Assessment of Semester Reviews:

- The write-up should be prepared as per the guidelines given by the department.
- The design and the development of the product shall be assessed through a presentation and demonstration of the working model by the student team to a panel of Internal and External Examiners, preferably from industry or any research organizations having an experience of more than five years, approved by the Head of the Institution. The presence of the external examiner is desirable only for the 2nd presentation in semester VI. Students are compulsorily required to present the outline of the extended technical paper prepared by them during the final review in semester VI.

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Program: Information Technology **T.Y B. Tech** **Semester: VI**

Course: Software Engineering (DJS22ITC601)
Course: Software Engineering Lab (DJS22ITL601)

Pre-requisite: N/A

Course Objectives: To explore the essential phases and critical aspects of an overall software development process in order to design a high-quality software solution in cost-effective manner for a real-world problem.

Course Outcomes: On successful completion of this course, student should be able to:

1. Select suitable software development lifecycle model(s) for software development.
2. Analyze real world problems using software engineering principles.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Software Process:** Software, Software Characteristics, Introduction to Software Engineering process, Process framework, Software Process Models – Sequential, Incremental and Evolutionary Process Models. **Agile Development Process:** Concept of Agility, Agile Process Models - Extreme programming-XP, SCRUM, Feature Driven Development, LEAN, KANBAN, ASD, DSD	**05**
2	**Requirements Engineering (Analysis & Specification):** Software Requirements – Functional and Non-Functional requirements, Requirement Engineering Process: Feasibility Studies, Requirement elicitation and analysis, requirements validation, requirements management, Software Requirements Specification SRS.	**03**
3	**Software Modelling & Design: Analysis Modeling** – Concept and approaches, UML design, Data Modeling, Scenario based Modeling, Flow Oriented Modeling, Design process – Design Concepts & Principles, Object Oriented Design –Architectural Design – Architectural styles, Architectural Design methodologies, Data Flow- User Interface Design: Interface analysis, Interface Design, Component level Design: Designing Class based components.	**12**
4	**Testing And Quality Assurance:** Software testing Fundamentals-Objectives of Testing, Strategic approach for software design, Testing Strategies, Testing Techniques (Black Box Testing & White Box Testing), Software Quality Measurement indicators, factors, criteria, SQA Plan, Software Quality Standards.	**05**
5	**Managing Software Project:** Metrics for Software Process and Projects – Software Measurement, Estimation – Decomposition techniques and Empirical estimation models, Project Scheduling – basic principles, timeline charts, Earn Value Analysis, Risk Management: Software Risk – Reactive v/s Proactive risk strategies, Risk Mitigation, Monitoring & Management, RMMM Plan, Change Management - Software Configuration Management, SCM Process, Change Control & Version Control	**08**
6	**Advanced Software Development Tools and Technologies:** DevOps: Introduction to DevOps, DevOps Principles, DevOps v/s Agile, Introduction to DevOps tools - Docker, Kubernets, Jenkin	**06**

List of Laboratory Experiments:

1. Project and its management: Write down the problem statement for a proposed system. Propose a
2. recommended SDLC model suitable for the system under development.
3. Perform detailed requirement analysis and develop Software Requirement Specification Sheet (SRS) as per IEEE format.
   a. Design Data Flow Diagram (DFD) up-to level 2 & E-R Diagram for the proposed system.
   b. Modeling the structural view for the system: Class diagram, object diagram.
   c. Modeling the behavioral aspect for the system: UML Use Case Diagram, Sequence Diagram & Activity diagram.
4. Project management activities:

a. Perform Project Scheduling using WBS Gantt Chart
b. Perform Project cost estimation using appropriate FP based / COCOMO Techniques.
c. Perform Risk Analysis and Design RMMM plan for the system under development.

5. Implementing Software Configuration Management process using Git, CVS, Bazaar etc.
6. Design test cases for testing the system under development and prepare test plan in IEEE format. Selenium tool.
7. Implementation of containerization (Create Basic HTML webpage/s and deploy web server) using Docker.
8. Demonstration of working of CICD pipeline (Continuous Integration and Continuous Deployment tools) e.g Jenkin.
9. Demonstration and Orchestration of Kubernet environment.
10. Mini Project

Books Recommended:

Text books:

1. Roger S Pressman, "Software Engineering: A Practitioner's Approach", 8th Edition, Mcgraw-Hill, 2015.
2. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education, 2011.

Reference Books:

1. Pankaj Jalot, "Software Engineering: A Precise Approach", Wiley India, 2010.
2. John M. Nicholas, "Project Management for Business and Technology", 3rd Edition, Pearson Education, 2000.
3. Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", 5th Edition, Mcgraw-Hill, 2009.

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Program: Information Technology **T.Y B. Tech** **Semester: VI**

Course: Machine Learning (DJS22ITC602)
Course: Machine Learning Laboratory (DJS22L602)

Pre-requisite: Data Structures, Basic Probability and Statistics, Algorithms, Data Mining

Course Objectives:
1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To become familiar with regression, classification and clustering tasks.
3. To become familiar with Dimensionality Reduction Techniques.

Course Outcomes: On completion of the course, student should be able to:
1. Gain knowledge about basic concepts of Machine Learning.
2. Identify machine learning techniques suitable for a given problem.
3. Apply various machine learning techniques.
4. Design application using machine learning techniques.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Machine Learning**: Types of Machine Learning, Steps involved in developing a Machine Learning Application, evaluating a Learning Algorithm: Deciding what to try next, Evaluating Hypothesis, Model Selection and Train/ Validation/ Test Sets, Bias Vs variance: Regularization and Bias/ Variance, Learning Curve, Error Analysis, Handling Skewed Data: Error Matrices for Skewed Classes, Trade-off between Precision and recall, Issues in Machine Learning, Application of Machine Learning	**06**
2	**Learning with Regression and trees:** Learning with Regression: Simple Linear Regression, Multiple Linear Regression, Logistic Regression. Learning with Trees: Decision Trees, Constructing Decision Trees using Gini Index, Classification and Regression Trees (CART).	**06**
3	**Dimensionality Reduction:** Dimensionality Reduction Techniques: Principal components analysis (Eigen values, Eigen vectors, Orthogonality), Independent Component Analysis, Single value decomposition.	**07**
4	**Classification**: Classification using Bayesian Belief networks, Hidden Markov Models Support Vector Machine: Maximum Margin Linear Separators, Quadratic Programming solution to finding maximum margin separators, Kernels for learning non-linear functions. Classification using k Nearest Neighbour Algorithm.	**08**
5	**Clustering:** Basics of clustering, Hard vs Soft Clustering, Density Based Clustering: DBSCAN, Expectation maximization (EM) for soft clustering, Semi-supervised learning with EM using labelled and unlabelled data, Radial Basis functions.	**07**
6	**Applications of Machine Learning:** Recommender Systems, Machine Learning for Image Recognition, Sentiment Analysis, Machine Learning for video surveillance	**05**

List of Laboratory Experiments:
1. To implement Linear Regression
2. To implement Logistic Regression
3. Implementing CART decision tree algorithm.
4. To implement Support Vector Machine.
5. To implement Bayesian Classification.
6. To implement PCA.
7. To implement K-Nearest Neighbour.
8. Implementing Radial basis functions.
9. Mini project based on any machine learning application.

A minimum of six experiments from the above suggested list or any other experiment based on syllabus will be included along with the mini project, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. Ethem Alpaydın, "Introduction to Machine Learning", 4th Edition, The MIT Press, 2020.
2. Peter Harrington, "Machine Learning in Action", 1st Edition, Dreamtech Press, 2012.
3. Tom Mitchell, "Machine Learning", 1st Edition, McGraw Hill, 2017.
4. Andreas C, Müller and Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists", 1st Edition, O'reilly, 2016.
5. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", 1st Edition, MIT Press, 2012.

Reference Books:

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 2nd Edition, Shroff/O'Reilly**,** 2019.
2. Witten Ian H., Eibe Frank, Mark A. Hall, and Christopher J. Pal., "Data Mining: Practical machine learning tools and techniques", 1st Edition, Morgan Kaufmann, 2016.
3. Han, Kamber, "Data Mining Concepts and Techniques", 3rd Edition, Morgan Kaufmann, 2012.
4. Mehryar Mohri, Afshin Rostamizadeh, and Ameet Talwalkar, "Foundations of Machine Learning", 1st Edition, The MIT Press, 2012.
5. H. Dunham, "Data Mining: Introductory and Advanced Topics", 1st Edition, Pearson Education, 2006.

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Program: Information Technology **T.Y B. Tech** **Semester: VI**

Course: Image Processing and Computer Vision (DJS22ITC603)
Course: Image Processing and Computer Vision Laboratory (DJS22ITL603)

Pre-requisite: Basic Mathematics, C Programming, Java, Python

Course Objectives: To introduce the concepts of image processing and basic analytical methods to be used in image processing. To familiarize students with image enhancement and restoration techniques, to explain different image compression techniques. To introduce segmentation and morphological processing techniques.

Course Outcomes: On successful completion of this course, student should be able to:
1. Understand the fundamentals of image processing.
2. Apply Image Enhancement Techniques.
3. Apply Image Segmentation Techniques.
4. Apply Image Compression Techniques.
5. Apply motion analysis on real time problem

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Digital Image Fundamentals:** Introduction to digital signals, Sampling and Reconstruction, Standard Discrete Time (DT) Signals, Concept of Digital Frequency, Representation of DT signal, Steps in Digital Image Processing, Components, Image Sampling and Quantization. Color Image Processing: Color Fundamentals, Color models Introduction to computer vision: Vision for measurement, Vision for perception, interpretation, Visual search and organization.	**04**
2	**Image Enhancement (point processing):** Image Negative, Thresholding, Graylevel slicing with and without background, power law and log transform, Contrast Stretching, Histogram equalization and Histogram Specification Image Enhancement in Spatial Domain (Neighbourhood processing): Low Pass and High Pass filtering for image enhancement, Basics of Spatial Filtering, Generating Spatial Filter Masks–Smoothing and Sharpening Spatial Filtering **Image Transforms:** 1-D DFT, 2-D Discrete Fourier Transform and Its Inverse, Some Properties of 2D DFT, Walsh -Hadamard, Discrete Cosine Transform, Haar Transform, Slant Transform Image Enhancement in Frequency Domain: The Basics of Filtering in the Frequency Domain, Smoothing and Sharpening frequency domain filters	**08**
3	**Image Morphology:** Erosion and Dilation, Opening and Closing, The Hit or-Miss Transformation. Restoration: Noise models – Mean Filters – Order Statistics – Adaptive filters – wiener filter.	**06**
4	**Image Segmentation:** Based on Discontinuities, Line Detection, Edge Detection, Canny Edge Detection, Gradients using Masks, segmentation based on 2nd order derivative, Hough Transform, Region Based Segmentation, Thresholding based segmentation, Image Pyramids, Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH	**08**
5	**Optical Flow:** Computations for motion estimation and depth calculation, Horn and Schunk, Lucas and Kanade algorithms, Motion Segmentation. Convolution Neural Networks: Design and Implementation.	**06**
6	**Image Compression:** Fundamentals of compression, Basic compression Methods, Huffman Coding, Arithmetic Coding, LZW Coding, Run- Length Coding, Symbol-Based Coding, Bit-Plane Coding, Block Transform Coding, Predictive Coding.	**07**

List of Laboratory Experiments:

1. Implementation of Geometric Transformations.
2. Implementation of Basic Image Manipulations.
3. Implementation of frequency domain Image Enhancement techniques
4. To perform Histogram equalization
5. To apply Prewitt and Sobel Operators on an image and analyze the obtained output.
6. To perform edge detection on an image using LoG, DoG and Canny Edge Detection Techniques.
7. To perform region-based segmentation
8. To perform morphological operations on Image
9. To perform Image restoration using various filters
10. To perform image compression

Books Recommended:

Text books:

1. Rafel C. Gonzalez and Richard E. Woods, "Digital Image Processing", 4th Edition, Pearson Education Asia, 2018.
2. Sanjit Mitra, "Digital Signal Processing: A Computer Based Approach", 4th Edition, Tata McGraw Hill, 2013.
3. Anil K. Jain, "Fundamentals and Digital Image Processing", 3rd Edition, Prentice Hall of India, 2008.
4. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011

Reference Books:

1. S. Salivahanan, A. Vallavaraj, C. Gnanapriya, "Digital Signal Processing", 4th Edition, Tata McGraw Hill Publication, 2019.
2. S. Jayaraman, E. Esakkirajan and T. Veerkumar, "Digital Image Processing", 1st Edition, Tata McGraw Hill Education Private Ltd, 2017.
3. S. Sridhar, "Digital Image Processing", 2nd Edition, Oxford university press, New Delhi, 2016.

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Program: Information Technology **T.Y B. Tech** **Semester: VI**

Course: Full Stack Web Development Lab (DJS22ITL604)

Pre-requisite: Knowledge of Web Programming

Course Objectives: The Full Stack Web Development lab using the MERN (MongoDB, Express.js, React, Node.js) stack aims to provide students with a comprehensive skill set to design, develop, and deploy modern web applications. Students will learn to create dynamic and responsive user interfaces using React on the front end, while mastering server-side programming with Node.js and Express.js on the back end. By the end of the lab, students should be proficient in building end-to-end web applications, with a focus on the MERN stack, and be well-prepared for the demands of full-stack development in the industry.

Course Outcomes: On successful completion of this course, student should be able to:
1. Develop a full stack web application.
2. Work effectively as a member of a team

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to MERN Stack:** Overview of MERN architecture and its components Setting up development environments for MongoDB, Express.js, React, and Node.js, Basic operations in MongoDB for data storage, NoSQL vs SQL.	04
2	**Front-End Development with React:** Implementing React Router for navigation and routing. Basic state management with hooks and Redux.	05
3	**Back-End Development with Node.js and Express.js:** Node.js basics: asynchronous JavaScript and event-driven architecture, Building RESTful APIs using Express.js for CRUD operations, Connecting Express.js with MongoDB using Mongoose for data manipulation	05
4	**Authentication and Authorization:** Implementing user authentication using JWT (JSON Web Tokens), Authorization strategies for protected routes in the MERN stack application	04
5	**Advanced Topics in MERN Stack:** Error handling and validation in the front-end and back-end Deployment strategies for MERN stack applications (e.g., Heroku, Netlify)	04
6	**Deployment and Project Showcase:** • Deployment strategies for MERN stack applications (Heroku, AWS, or other platforms) • APIs with middleware, validation, and security mechanisms. • Best practices and real-world scenarios	04

List of Laboratory Experiments: (Two-Hour Sessions)

1. **Setting Up MERN Stack Environment**
   Install necessary software/tools and verify basic functionality for each component.
2. **Building a Simple React Application**
   Create a simple React app with multiple components, manage state, and pass props **Connecting React Front-End to Express.js Back-End**
3. **Creating RESTful APIs with Express.js**
   Create a MongoDB database, design basic schemas, and execute CRUD operations using the MongoDB driver.
4. **Connecting Express.js with MongoDB**
   Set up database connections, define schemas, and execute CRUD operations using Mongoose.
5. **Authentication and Authorization with JWT**
   Implement user authentication using JWT tokens for a simple login/signup functionality.
6. **React Router and Navigation**
   Implement React Router for basic navigation between different components/pages within a React application.
7. **Data Validation and Error Handling**
   Implement input validation in React components and handle basic errors in Express.js.
8. **Deployment of MERN Stack App**
   Deploy the completed MERN stack project to a chosen hosting service (e.g., Heroku, Netlify).
9. **Advanced API Features and Security**
   Enhance APIs with middleware, validation, and security mechanisms (e.g., rate limiting, CORS).
10. **Deployment and Project Showcase**

Prepare the MERN stack project for deployment by setting up hosting platforms and preparing presentation materials.

Books Recommended:

Text books:

1. Vasan Subramanian, "Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node", 2nd Edition, Apress, 2019.
2. Kirupa Chinnathambi, "Learning React: A Hands-On Guide to Building Web Applications Using React and Redux", 2nd Edition, Addison-Wesley Professional, 2018.
3. Shannon Bradshaw, Eoin Brazil, Kristina Chodorow, and Michael Dirolf, "MongoDB: The Definitive Guide", 3rd Edition, O'Reilly, 2019.
4. Julien Vehent, "Securing DevOps: Security in the Cloud", 1st Edition, Manning, 2018.

Reference Books:

1. David Herron, "Node.js Web Development", 5th Edition, Packt, 2020.
2. Evan M. Hahn, "Express in Action",1st Edition, Manning, 2016.

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Program: Information Technology **T.Y B. Tech** **Semester: VI**

Course: Infrastructure Security (DJS22ITC6011)
Course: Infrastructure Security Laboratory (DJS22ITL6011)

Pre-requisite: Knowledge of
1. Computer Networks
2. Cryptography and Network Security

Course Objectives: The course introduces students to the underlying principle of securing the IT infrastructure with the help of different prevention techniques and policies.

Course Outcomes: On successful completion of this course, student should be able to:
1. Gain comprehensive knowledge of access control policies, multilevel security, and AAA models.
2. Proficient in identifying and addressing software vulnerabilities, operating system security, and database security.
3. Apply cloud data security strategies, encryption practices, key management, and compliance with industry or regulatory requirements.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Access Control Policies and Multilevel Security:** Cyber Threats, Cyber-attacks – Stages, Malware and types, **Multilevel Security**: Access Control Policies and Models (DAC, MAC, RBAC, ABAC, BIBA, Bell La Padula), AAA model: Authentication and Access Control Services- RADIUS, TACACS+ SAN **Security:** LUN Masking, SAN Zoning Port Authentication. **Security Frameworks**: NIST, COBIT. Financial Guidelines.	**05**
2	**Software Security:** **Software Vulnerabilities:** Buffer overflow, Format String, Cross-Site Scripting, SQL Injection, **Operating System Security:** Memory and Address Protection, File Protection Mechanism, User Authentication. Linux and Windows: Vulnerabilities, File System Security. **Database Security:** Database Security Requirements, Reliability and Integrity, Sensitive Data, Inference Attacks, Multilevel Database Security,	**10**
3	**Web and Mobile Security:** Wireless Security Mobile Device Security- Security Threats, Device Security, End to End Encryptions, OWASP Top Ten, Input Validation and Sanitization, Authentication and Session Management, Cookies, SSL, HTTPS, SSH, Browser Attacks, Account Harvesting, Web Bugs, Clickjacking, CrossSite Request Forgery, Security Testing and Vulnerability Scanning, Incident Response and Web Security Monitoring. Compliance and Regulations: GDPR, HIPAA, OWASP, SAML.	**06**
4	**Cloud Security**: Cloud Architecture, Service Models and Design, Cloud Security Concepts, Cloud Security Risks and Countermeasures, Cloud Application Security, Cloud Identity and Access Management, Cloud Security as a Service **Federated Identity Management:** Cloud Migration security considerations, Cloud Configuration & Patch Management, Securing Compute and Storage Cloud Infrastructure Audit. Cloud Sizing, Cloud Elastic Management.	**06**
5	**Cloud Data Security:** Cloud Data Security Foundational Strategies, Encryption, Egress monitoring, Masking, Obfuscation, Anonymization & tokenization, Key management. Data Asset Management and Protection, Industry or Regulatory Requirements, Data Asset Management in the Cloud, Protecting Data in the Cloud, Cryptographic erasure, Types of Cloud Assets, Asset Management Pipeline, Procurement Leaks, Tooling Leaks, Findings Leaks, Tagging Cloud Assets, Life Cycle for Identity and Access.	**06**
6	**Administering Security:** Security plans- Business continuity plan, Incident response plan, Risk Analysis- Nature of risk, steps of risk analysis, Organizational Security Policies, End Point Security Best Practices, Defining Endpoints, Why Security Fails, Missing Link Discovered, Endpoints and Network Integration, Trustworthy Beginnings, Threat Vectors, Case Studies of Endpoint Security Failures.	**06**

List of Laboratory Experiments:

1. Installing and exploring Kali Linux and the inbuilt tools for reconnaissance and ethical hacking.
2. Implementation and analysis of SQL injection Attack.
3. Implementation of Buffer overflow attack and its analysis using Splint, Cppcheck etc.
4. Exploring Authentication and access control using RADIUS, TACACS and TACACS+.
5. Configuration of mod Security, core rule set on Apache server.
6. Implement Amazon GuardDuty to identify and detect any atypical or potentially suspicious activities occurring within your AWS account or systems.
7. Study and Implement Amazon CloudWatch Logs, Azure Monitor, Google Stackdriver Logging, to provide robust log storage and retrieval capabilities to store and query log data for monitoring and analysis.
8. Study and apply various IDS tools viz. CloudFlare, Akamai, and Signal Sciences to provide cloud-based web application firewall solutions.
9. Exploring various tools for Infrastructure Security: Firewall, antimalware systems, Penetration testing and network vulnerability analysis tools, intrusion detection system, Authentication software, Password auditing tools, Encryption tools, Security information and event management (SIEM) tools.
10. Explore vulnerability scanning tool (e.g., Nessus) to scan the system for potential vulnerabilities.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Books Recommended:

Text books:

1. William Stallings, "Computer Security Principles and Practice", 6th Edition, Pearson Education, 2014.
2. Charles P. Pfleeger, "Security in Computing", 5th Edition, Pearson Education, 2015.
3. Chris Dotson, "Practical Cloud Security", 1st Edition, O'Reielly, 2019.
4. Mark Kadrich, "Endpoint Security", 1st Edition, Addison Wessley, 2007.

Reference Books:

1. Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", 1st Edition, CRC Press, 2015.
2. Tim Boyle, "CCNA Security Study Guide", 1st Edition, Wiley, 2010.

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Program: Information Technology **T.Y B. Tech Semester: VI**

Course: Internet of Things (DJS22ITC6012)
Course: Internet of Things Laboratory (DJS22ITL6012)

Pre-requisite: Knowledge of Microcontrollers, Sensors, Wireless Networks.

Course Objectives: The objective of this course is to provide a comprehensive introduction to the interconnection and integration of physical devices and the Internet. The course familiarizes students with the concepts, applications, and protocols of IoT. The student will design and develop IoT based applications using different embedded boards like Arduino, Raspberry Pi, Intel Galileo etc..

Course Outcomes: On successful completion of this course, student should be able to:
1. Identify suitable enabler technologies for designing IoT based applications.
2. Analyze cloud data for IoT applications.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to IoT:** History of IoT, IoT Conceptual Framework, IoT Architectural View, Enabling Technologies of IoT, Major Components of IoT System, M2M Communication, Hardware Sources for IoT (Arduino, Intel Galileo, Intel Edison, Beagle Board, Raspberry Pi), Examples of IoT	04
2	**Design Principles for Connected Devices:** IoT/M2M System Layers, Design Standardization, Communication Technologies (NFC, RFID, ZigBee, Bluetooth, WiFi), Web Communication Protocols, Message Communication Protocols, Web Connectivity using SOAP, REST, and WebSockets	06
3	**Internet Connectivity Principles:** Internet Based Communication, Internet Protocols (IPv4, IPv6, Routing Protocol for Low Power Lossy Networks), 6LoWPAN, TCP/IP, UDP, IP Addressing in IoT, Static and Dynamic IP address, DNS, DHCP, Application Layer Protocols (HTTP, HTTPS, FTP, TELNET)	08
4	**Data Computing using Cloud Platform:** Data Acquisition and Storage, Data Categorization for Storage, Organizing the Data, Data Processing and Analytics (Descriptive, Predictive, Prescriptive), Analytics using Big Data in IoT, Data Analytics Architecture, Cloud Computing Paradigm, Cloud Deployment Models (Public, Private, Community, Hybrid), Cloud Based IoT Services (XIVELY, NIMBITS)	08
5	**Sensors, RFIDs, and WSNs:** Sensor Technology (Resistive, Capacitive, Transistor-based sensors), Analog Sensors, Digital Sensors, Principle of RFID, RFID IoT Systems, Components of RFID System, RFID Technological and Security Challenges, RFID Applications, WSN Architecture (Layered Architecture, Multi-Cluster Architecture), WSN Protocols (S-MAC, SPINS, SNEP, μ-TESLA), WSN IoT Applications	07
6	**IoT Privacy, Security, and Vulnerability Solutions:** Introduction, Privacy, Vulnerability of IoT, Role of OWASP, Security Requirements, Threat Analysis, Layered Attacker Model (LAM), Possible attacks in LAM, Solutions for Mitigating Attacks, Identity Management, Access Control	06

Lab guidelines for mini project:
1. The mini project work is to be conducted by a group of three students (four in extreme case; call can be taken by subject in-charge)
2. The group should meet with the concerned faculty during laboratory hours and document the progress of work
3. The students should be given sufficient time (6-8 hrs) to do a survey for finalizing their mini project topic using Raspberry Pi / Arduino / ARM Cortex / Intel Galileo etc.
4. Each group will identify a potential problem statement on which the study and implementation is to be conducted and will also identify the hardware and software requirements for their mini project.
5. Once the topic has been finalized, students either can buy the required components by themselves or can request the college to provide the components.
6. Concerned faculty will do the term work assessment after seeing the group's presentation and overall implementation of the mini project.
7. Each group may present their work in various project competitions and paper presentations.

8. A detailed report is to be prepared as per guidelines given by the concerned faculty

Books Recommended:

Text books:

1. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, Mc Graw Hill, 2017.
2. Hakima Chaouchi, "Internet of Things: Connecting Objects to the Web", 1st Edition, Wiley, 2013

Reference Books:

1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", 1st Edition, Wiley, 2013.
2. Dr. Ovidiu Vermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", 1st Edition, River Publishers, 2013.
3. Vijay Madisetti, Arshdeep Bahga, Internet of Things (A Hands-on-Approach), 1st Edition, Orient Blackswan Private Limited - New Delhi, 2015.

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Program: Information Technology **T.Y B. Tech** **Semester: VI**

Course: Augmented Reality and Virtual Reality (DJS22ITC6013)
Course: Augmented Reality and Virtual Reality Laboratory (DJS22ITL6013)

Pre-requisite: Computer graphics, Programming in C/JAVA.

Course Objectives: The course aims to introduce students to the basic concepts and framework of augmented and virtual reality. The course introduces students the technology for multimodal user interaction and perception in Virtual Reality (VR), in particular, the visual, audial and haptic interface and behaviour and the technology for managing large scale Augmented Reality (AR) and VR environment.

Course Outcomes: On successful completion of this course, student should be able to:
1. Develop Virtual Reality applications.
2. Develop Augmented Reality applications.
3. Work effectively as a member of a team.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Virtual Reality (VR):** Definition and Scope, Types of VR, Characteristics of VR, Basic VR environments, Limitations of VR environments, Immersion Vs Presence, Key hardware requirements for VR	**05**
2	**Interface to the Virtual World:** Input: User Monitoring, Position Tracking, Body Tracking, Physical input Devices, Speech Recognition (Audio Input) and World Monitoring: Persistent Virtual Worlds, Bringing the Real World into the Virtual World. Output: Visual Displays: Properties of Visual Displays, Monitor-based or Fishtank-VR, Projection-based VR, Head-based VR, See-through Head-based Displays, Handheld VR. Aural Displays: Properties of Aural Displays, Head-based Aural Displays- Headphones, Stationary Aural Displays-Speakers. Haptic Displays: Properties of Haptic Displays, Tactile Haptic Displays, End-effector Displays, Robotically Operated Shape Displays, Vestibular and Other Senses.	**07**
3	**Representing and Rendering the Virtual World:** Representation of the Virtual World: Visual Representation in Virtual Reality, Aural Representation and Haptic Representation in Virtual Reality Rendering Systems: Visual Rendering Systems: Visual Rendering Methods, Geometrically Based Rendering Systems, Non-geometric Rendering Systems, Rendering Complex Visual Scenes, Computer Graphics System Requirements. Aural Rendering Systems: Visual Rendering Methods, Rendering Complex Sounds, Sound Generation Hardware, Internal Computer Representation. Haptic Rendering Systems: Haptic Rendering Methods, Rendering Complex Haptic Scenes with Force Displays, Haptic Rendering Techniques	**07**
4	**Interacting with the Virtual World and Virtual Reality Experience:** User Interface Metaphors, Manipulating a Virtual World, Properties of Manipulation, Manipulation Operations, Navigating in a Virtual World-Way finding and Travelling, Classes of Travel Methods Interacting with Others-Shared Experience, Collaborative Interaction, Interacting with the VR System, Immersion, Rules of the Virtual World: Physics, Substance of the Virtual World.	**07**
5	**Introduction to Augmented Reality (AR):** Definition and Scope, A Brief History of Augmented Reality, Displays (Multimodal Displays, Spatial Display Model, and Visual Displays), Strong vs Weak AR, Augmented Reality Hardware (Sensors, Processors, Displays), Ingredients of an AR Experience Dimensionality, Depth Cues, Registration and Latency, Working of Augmented Reality, Applications of AR, Challenges in AR	**06**
6	**Augmented Reality Software and Mobile Augmented Reality:** Augmented Reality Systems, Software Components, Software Tools for Content Creation, Interaction in Augmented Reality, Augmented Reality Techniques: Marker based and Marker less tracking, Mobile Augmented Reality.	**07**

List of Laboratory Experiments:
1. Installation of Unity and Visual Studio, setting up Unity for VR development, understanding documentation of the same.
2. Demonstration of the working of HTC Vive, Google Daydream or Samsung gear VR.

3. Develop a scene in Unity that includes:
   a. A cube, plane and sphere, apply transformations on the 3 game objects.
   b. Add a video and audio source.
4. Develop a scene in Unity that includes a cube, plane and sphere. Create a new material and texture separately for three Game objects. Change the color, material and texture of each Game object separately in the scene. Write a C# program in visual studio to change the color and material/texture of the game objects dynamically on button click.
5. Develop and deploy a simple marker-based AR app in which you have to write a C# program to play video on tracking a particular marker.
6. Develop and deploy an AR app, implement the following using Vuforia Engine developer portal: i. Plane detection ii. Marker based Tracking (Create a database of objects to be tracked in Vuforia) iii. Object Tracking
7. Mini Project.

Books Recommended:

Textbooks:

1. William R Sherman and Alan B Craig, "Understanding Virtual Reality: Interface, Application and Design", 1st Edition, Morgan Kaufmann Publishers, San Francisco, CA, 2002.
2. Alan B Craig, "Understanding Augmented Reality, Concepts and Applications", 1st Edition, Morgan Kaufmann Publishers, 2013.
3. Burdea, G. C. and P. Coffet. "Virtual Reality Technology", 2nd Edition. Wiley-IEEE Press, 2003.

Reference Books:

1. Alan Craig, William Sherman and Jeffrey Will, "Developing Virtual Reality Applications, Foundations of Effective Design", 1st Edition, Morgan Kaufmann, 2009.
2. Schmalstieg / Hollerer, "Augmented Reality: Principles & Practice", 1st Edition, Pearson Education India, 2016.
3. Sanni Siltanen, "Theory and applications of marker-based augmented reality", 1st Edition, Julkaisija –Utgivare Publisher, 2012.
4. Steven M. LaValle, "Virtual Reality", 1st Edition, Cambridge University Press, 2016.

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Program: Information Technology **T.Y B. Tech** **Semester: VI**

Course: Big Data Analytics (DJS22ITC6014)
Course: Big Data Analytics Laboratory (DJS22ITL6014)

Pre-requisite: Knowledge of Data Mining Algorithm.

Course Objectives: To explore Big Data technology with the help of Big Data Analytics tools to analyze the growing volume, velocity, and variety of data to get the insights.

Course Outcomes: On successful completion of this course, student should be able to:
1. Identify big data applications using its characteristics.
2. Explore Hadoop Ecosystem with their roles to solve Big Data problems.
3. Apply advanced data mining algorithm for big data analytics.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Big Data:** Introduction to Big Data Framework, Types of Big Data, Big Data characteristics, Big Data Storage techniques, Traditional Analytical Architecture, Need of big data frameworks, Traditional vs. Big Data business approach, Big Data Challenges, RAID, Big data on Cloud, Big Data Applications (Examples of Big Data in Real Life), Latest trends in Big Data	03
2	**Hadoop and MapReduce:** Introduction to Hadoop, Core Hadoop Components, Hadoop Distributed File System (HDFS) & Architecture, MapReduce – Introduction, The Map Tasks, The Reduce Tasks, Combiners, Components of MapReduce, Details of MapReduce Execution, MapReduce Algorithms and applications - Matrix-Vector Multiplication by MapReduce, Relational-Algebra Operations	05
3	**Hadoop Ecosystem**: Introduction to Hadoop Ecosystem components, Reading and Writing Large Datasets – Apache PIG, Apache HIVE, Apache Sqoop, Hadoop Management: YARN, Apache Oozie, Apache Zookeeper, Apache Ambari, NOSQL: No SQL databases, Introduction – Features - Data types, No document database, relationships, data architecture patterns: Key-value stores, Graph database and Analysis, Column family (Bigtable) stores, Document stores, Mongo DB, HBase, Introduction to Apache Spark, data analysis with Spark	12
4	**Mining Big Data Streams: introduction - Data stream mining,** The Stream Data Model - A DataStream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing. Sampling Data in a Stream- Sampling Techniques. Filtering Streams: The Bloom Filter. Counting Distinct Elements in a Stream - The Count-Distinct Problem, The Flajolet-Martin Algorithm, Combining Estimates, Space Requirements. Counting Ones in a Window - The Cost of Exact Counts, The Datar-Gionis-Indyk Motwani Algorithm, and Query Answering in the DGIM Algorithm.	08
5	**Frequent Pattern Mining:** Handling Larger Datasets in Main Memory Basic Algorithm of Park, Chen, and Yu. The SON Algorithm and MapReduce. Clustering Algorithms: CURE Algorithm. Canopy Clustering, Clustering with MapReduce	05
6	**Big Data Analytics Applications:** **Link Analysis** - PageRank Definition, Structure of the web, dead ends, Using Page rank in a search engine, Efficient computation of Page Rank: PageRank Iteration Using MapReduce, Topic sensitive Page Rank, link Spam, Hubs and Authorities, HITS Algorithm. **Mining Social - Netwo**rk Graphs - Social Networks as Graphs, Types of Social Networks, Clustering of Social Network Graphs, Clique Percolation Method.	06

List of Laboratory Experiments:
1. Install and configure a small Hadoop cluster using virtual machines or cloud services.
2. Implement the following file management tasks in Hadoop:
    a. Adding files and directories
    b. Retrieving files
    c. Deleting files
3. To apply MapReduce to implement Word Count algorithm.

4. To implement Matrix Vector Multiplication with Hadoop Map Reduce.
5. To install and Run Pig to write Pig Latin scripts to sort, group, join, project, and filter data.
6. To install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.
7. Set up HBase and perform Create, Read, Update, and Delete operations on data stored in HBase tables.
8. To perform NoSQL database using Mongo dB to create, update and insert.
9. To write Spark application to perform data Analysis using PySpark.
10. Explore technologies like Apache Kafka for real-time data streaming and processing.
11. To implement Bloom Filters for filter on Stream Data in C++/java/ Scala.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Books Recommended:

Textbooks:

1. Anand Rajaraman, Jeff Ullman, "Mining of Massive Datasets", 2nd Edition, Cambridge University Press, 2014.
2. Radha Shankarmani, M Vijayalakshmi, "Big Data Analytics", 2nd Edition, Wiley Publications, 2016.
3. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media, Inc., 2015
4. Alex Holmes, "Hadoop in Practice", 2nd Edition, Manning Press, Dreamtech Press, 2015.
5. Han, Kamber, "Data Mining Concepts and Techniques", 3rd Edition, Morgan Kaufmann, 2011.

Reference Books:

1. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", 1st Edition, Wiley Big Data Series, 2017.
2. Vignesh Prajapati, "Big Data Analytics with R and Hadoop", 1st Edition, Packt Publishing Limited, 2013.
3. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'Reilly Publications, 2016.

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Program: Information Technology **T.Y B. Tech** **Semester: VI**

Course: Information Systems and IT Governance (DJS22ITC6015)
Course: Information Systems and IT Governance Laboratory (DJS22ITL6015)

Pre-requisite: NA

Course Objective: The objective of this course is to expose the students to the managerial issues relating to information systems and IT investments. The course also familiarizes students with the various initiatives taken by the government for promoting E-Governance, E-Governance models and IT Act.

Course Outcomes: On successful completion of this course, student should be able to:
1. Describe the types of support that an information system can provide to each functional area of the organization.
2. Align IT investment decisions with the goals and strategies of the organization.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Overview of Information Systems:** Introduction to Information Systems, Types of Information Systems: Operations Support Systems, Management Support Systems, Expert Systems, and Knowledge Management Systems.	04
2	**Information Systems for Strategic Management:** Competitive Strategy Concepts, Strategic Role of Information Systems. Integrating Information Systems with Business Strategy, Value Chain Analysis, and Strategic Information Systems Framework.	06
3	**IT Investments and Alignment:** IT Investments and Goals at Organization, Framework for IT Governance, Who Makes the Decisions, How IT Decisions are Made, IT Decisions at Organization, Key Principles and Practices, Operating Model and Enterprise Architecture, Application Silo Stage, Implications of Enterprise Stages.	06
4	**Evaluating IT Investments:** Definition of IT Investment Portfolio, Characteristics of Different IT Asset Classes, Strategic Orientation, Portfolio Management, Four Elements of IT Investment Portfolios, IT Chargeback, Compare Alternative Approaches to IT Chargeback, Implications of IT Chargeback, Net Profit Value, Key Risks in IT Investment.	06
5	**Change Management:** Understanding User Resistance, Different Models of User Adoption, Different Levers for Affecting User Adoption, Evolutionary vs. Revolutionary Change, Project Management vs. Learning Approach, implementing a New System at Organization, Defending Against Pitfalls	04
6	**E-Governance:** Introduction to E-Governance, Need for and Importance of E-Governance, Stages of E-Governance, National E-Governance Plan (NeGP), Role of ICT in E-Governance, Categories of E-Governance, Key Issues of E-Governance, Technology, Policies, Infrastructure, Training, Copyrights, Consulting Funds.	08

List of Laboratory Experiments:
1. Study of Information System and its types
2. Study of Decision Support System, Users and Characteristics
3. Study of IT Investment Decisions at Organizational Level
4. Calculating Net Present Value and Profitability Index of an Investment
5. Study of Evolutionary and Revolutionary Change
6. Study of Different E-Governance Models
7. Case study on Value Chain Analysis
8. Case study on IT Investment Portfolios
9. Case study on National E-Governance Plan (NeGP)
10. Case study on Interactive Service Model (G2C2G)

Books Recommended:
Text books:
1. Turban, E., McLean, E. and Wetherbe, J., "Information Technology for Management: Making Connections for Strategic Advantage", 2nd Edition, John Wiley and Sons, 2000.

2. D.P.Goyal. “Management Information Systems-Managerial Perspectives”, 2nd Edition, Macmillan, New Delhi, 2006.

Reference Books:

1. James A O’Brien, George M Marakas and Ramesh Behl, “Management Information Systems”, 9th Edition, Tata McGraw Hill Education, New Delhi, 2009.
2. D N Gupta, “E Governance a Comprehensive Framework”, 1st Edition, Jain Publications, 2008.

Prepared by Checked by Head of the Department Principal

Program: Information Technology **T.Y B. Tech** **Semester: VI**

Course: Innovative ProductDevelopment IV (DJS22ILL2)

Pre-requisite: NA

Course Objectives:

1. To acquaint the students with the process of identifying the need (considering a societal requirement) and ensuring that a solution is found out to address the same by designing and developing an innovative product.
2. To familiarize the students with the process of designing and developing a product, while they work as part of a team.
3. To acquaint the students with the process of applying basic engineering fundamentals, so as to attempt at the design and development of a successful value-added product.
4. To inculcate the basic concepts of entrepreneurship and the process of self-learning and research required to conceptualize and create a successful product.

Course Outcomes: On successful completion of this course, student should be able to:

1. Identify the requirement for a product based on societal/research needs.
2. Apply knowledge and skills required to solve a societal need by conceptualizing a product, especially while working in a team.
3. Use standard norms of engineering concepts/practices in the design and development of an innovative product.
4. Draw proper inferences through theoretical/ experimental/simulations and analyses the impact of the proposed method of design and development of the product.
5. Develop interpersonal skills, while working as a member of the team or as the leader.
6. Demonstrate capabilities of self-learning as part of the team, leading to life-long learning, which could eventually prepare themselves to be successful entrepreneurs.
7. Demonstrate product/project management principles during the design and development work and also excel in written (Technical paper preparation) as well as oral communication.

Guidelines for the proposed product design and development:

- Students shall convert the solution designed in semester 3 and 4 into a working model, using various components drawn from their domain as well as related interdisciplinary areas.
- The working model is to be validated with proper justification and the report is to be compiled in a standard format and submitted to the department. Efforts are to be made by the students to try and publish the extended technical paper, either in the institute journal, “Techno Focus: Journal for Budding Engineers” or at a suitable publication, approved by the department research committee/ Head of the department.
- Faculty supervisor may provide inputs to students during the entire span of the activity, spread over 2 semesters, wherein the main focus shall be on self-learning.
- A record in the form of an activity log-book is to be prepared by each team, wherein the team can record weekly progress of work. The guide/supervisor should verify the recorded notes/comments and approve the same on a weekly basis.
- The focus should be on self-learning, capability to design and innovate new products as well as on developing the ability to address societal problems. Advancement of entrepreneurial capabilities and quality development of the students through the year long course should ensure that the design and development of a product of appropriate level and quality is carried out, spread over two semesters, i.e. during the semesters V and VI.

Guidelines for Assessment of the work:

- The review/ progress monitoring committee shall be constituted by the Head of the Department. The progress of design and development of the product is to be evaluated on a continuous basis, holding a minimum of two reviews in each semester.
- In the continuous assessment, focus shall also be on each individual student’s contribution to the team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.
- Oral examination should be conducted by Internal and External examiners. Students have to give presentation and demonstration on their working model
- The distribution of marks for term work shall be as follows:
    1. Marks awarded by the supervisor based on log-book: 10
    2. Marks awarded by review committee: 10
    3. Quality of the write-up: 05

The overall work done by the team shall be assessed based on the following criteria;

1. Quality of survey/ need identification of the product.
2. Clarity of Problem definition (design and development) based on need.
3. Innovativeness in the proposed design.
4. Feasibility of the proposed design and selection of the best solution.
5. Cost effectiveness of the product.
6. Societal impact of the product.
7. Functioning of the working model as per stated requirements.
8. Effective use of standard engineering norms.
9. Contribution of each individual as a member or the team leader.
10. Clarity on the write-up and the technical paper prepared.

- The semester reviews (V and VI) may be based on relevant points listed above, as applicable.

Guidelines for Assessment of Semester Reviews:

- The write-up should be prepared as per the guidelines given by the department.
- The design and the development of the product shall be assessed through a presentation and demonstration of the working model by the student team to a panel of Internal and External Examiners, preferably from industry or any research organizations having an experience of more than five years, approved by the Head of the Institution. The presence of the external examiner is desirable only for the 2nd presentation in semester VI. Students are compulsorily required to present the outline of the extended technical paper prepared by them during the final review in semester VI.

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