Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and Detailed Syllabus (DJ19)

Third Year B.Tech

in

Information Technology

(Semester V and VI)

Revision: 1 (2021)
With effect from the Academic Year: 2021-2022

1st July, 2021

Scheme for Third Year Undergraduate Program in Information Technology : Semester V (Autonomous)
(Academic Year 2021-2022)

Semester V

Sr	Course Code	Course	Teaching Scheme				Semester End Examination (A)						Continuous Assessment (B)					Aggregate (A+B)	Credits earned	
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	SEE Total (A)	Term Test 1 (TT1)	Term Test 2 (TT2)	Avg (TT1 & TT2)	Term Work Total	CA Total (B)			
1	DJ19ITC501	Cryptography and Network Security	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ITL501	Cryptography and Network Security Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
2	DJ19ITC502	Advanced Data Structures	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ITL502	Advanced Data Structures Laboratory	--	2	--	1	--	--	--	25	--	25	--	--	--	25	25	50	1	
3	DJ19ITC503	Data Warehousing and Mining	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ITL503	Data Warehousing and Mining Laboratory	--	2	--	1	--	--	25	--		25	--	--	--	25	25	50	1	
4	DJ19ITC504	Artificial Intelligence	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ITL504	Artificial Intelligence Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
5@	DJ19ITEC5011	Microcontrollers and Embedded Systems	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ITEL5011	Microcontrollers and Embedded Systems Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ITEC5012	Human Computer Interaction	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ITEL5012	Human Computer Interaction Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ITEC5013	Statistical Analysis	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ITEL5013	Statistical Analysis Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
6#	DJ19IHL2	Professional and Business Communication Laboratory	--	4	--	2	--	--	--	--	--	--	--	--	--	50	50	50	2	2
7	DJ19ILL1	Innovative Product Development - III	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	1
		Total	**15**	**16**	**0**	**23**	**17**	**375**	**125**	**25**	**0**	**525**	**125**	**125**	**125**	**200**	**325**	**850**	**23**	

@ Any 1 elective course

2 hrs. of theory (class wise) and 2 hrs of activity based laboratory (batch wise)

Prepared by Checked by **Head of the Department** **Vice Principal** **Principal**

Scheme for Third Year Undergraduate Program in Information Technology : Semester VI (Autonomous)
(Academic Year 2021-2022)

Semester VI

Sr	Course Code	Course	Teaching Scheme				Semester End Examination (A)						Continuous Assessment (B)					Aggregate (A+B)	Credits earned	
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	SEE Total (A)	Term Test 1 (TT1)	Term Test 2 (TT2)	Avg (TT1 & TT2)	Term Work Total	CA Total (B)			
1	DJ19ITC601	Parallel and Distributed Computing	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ITL601	Parallel and Distributed Computing Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
2	DJ19ITC602	Software Engineering	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ITL602	Software Engineering Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
3	DJ19ITC603	Image Analysis and Computer Vision	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ITL603	Image Analysis and Computer Vision Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
4 & 5@	DJ19ITEC6011	Internet of Things	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	8
	DJ19ITEL6011	Internet of Things Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ITEC6012	UI / UX	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ITEL6012	UI / UX Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ITEC6013	Big Data Analytics	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ITEL6013	Big Data Analysis Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ITEC6014	Soft Computing	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ITEL6014	Soft Computing Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ITEC6015	Infrastructure Security	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ITEL6015	Infrastructure Security Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ITEC6016	Information Systems & IT Governance	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ITEL6016	Information Systems & IT Governance Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
6	DJ19ILL2	Innovative Product Development - IV	--	2	--	1	2	--	--	--	25	25	--	--	--	25	25	50	1	1
7	DJ19A5	Environmental Studies	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Total	**16**	**12**	**0**	**21**	**17**	**375**	**125**	**0**	**25**	**525**	**125**	**125**	**125**	**150**	**275**	**800**	**21**	

@ Any 2 Elective Course

Prepared by Checked by **Head of the Department** **Vice Principal** **Principal**

Program: Third Year Information Technology	Semester : V
Course : Cryptography and Network Security	Course Code: DJ19ITC501
Course : Cryptography and Network Security Laboratory	Course Code: DJ19ITL501

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	25
3	2	-	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

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 Objective: 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: By the end of the course, students 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 and elliptic curve cryptosystems.	07
4	**Cryptographic Hashes, Message Digests:** Authentication requirement – Authentication	05

	function, Types of Authentication, MAC – Hash function – Security of hash function and MAC –MD5 – SHA – HMAC – CMAC-PMAC, hash chain and hash tree (Merkletree)	
5	**Authentication Protocols:** Needham Schroeder Authentication protocol, Authentication Applications, Kerberos, Key Management, challenge response protocols, Zero knowledge protocols, Diffie Hellman Key exchange, Digital Certificate: X.509 (EC), PKI Digital Signature Schemes – RSA, DSS.	**08**
6	**Network Security:** Overview of OSI Layer attacks, Network Security Model, SSL, TLS, IPSEC: AH, ESP, Secure Email: PGP and S/MIME Firewalls, Intrusion Detection Systems: Host Based and Network Based IDS.	**07**

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:

Text Books:

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, 2013.
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.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practical's performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 10 experiments and/or Tutorial / Mini project / Presentation/Assignment/ Quiz.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Tutorial / Mini project / Presentation/Assignment/ Quiz: 10 marks

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

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology Engineering	Semester : V
Course : Advanced Data Structures	Course Code: DJ19ITC502
Course : Advanced Data Structures Laboratory	Course Code: DJ19ITL502

<table>
<tr><th colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</th><th colspan="8">Evaluation Scheme</th></tr>
<tr><th colspan="3">Semester End Examination Marks (A)</th><th colspan="4">Continuous Assessment Marks (B)</th><th rowspan="2">Total marks (A+ B)</th></tr>
<tr><th rowspan="2">Lectures</th><th rowspan="2">Practical</th><th rowspan="2">Tutorial</th><th rowspan="2">Total Credits</th><th colspan="3">Theory</th><th>Term Test 1</th><th>Term Test 2</th><th>Avg.</th></tr>
<tr><td colspan="3">75</td><td>25</td><td>25</td><td>25</td><td>100</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">2</td><td rowspan="3">--</td><td rowspan="3">4</td><td colspan="3">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="2">Total Term work</td><td rowspan="3">50</td></tr>
<tr><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td>Tutorial / Mini project / presentation/ Journal</td><td></td></tr>
<tr><td>--</td><td>--</td><td>25</td><td>15</td><td>10</td><td>25</td></tr>
</table>

Pre-requisite: Knowledge of -

1. Data Structures and any programming language like C or JAVA

Course Objectives: This course emphasizes on 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, 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.	08
4	**External Memory Data Structures:** B Tree, B+ Tree, B* Tree, (a, b) Tree, Counted B Tree, Buffer Tree, Fenwick Tree with application.	07
5	**Spatial Data Structures:** Interval, Segment, Range, Priority Search Tree, KD Tree, Quad Tree, OCTree, R Tree with application.	08

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.	**08**

List of Laboratory Experiments: (Any 10)

Minimum 1 experiments 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.

Lab Session	Title
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 data structure.
6	Experiment on Spatial data structure.
7	Experiment on Hash Tables.

Books Recommended:

Text books:

1. Peter Brass, "Advanced Data Structures", 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", 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.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in the syllabus.
3. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral & Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Consisting of Two Compulsory Class Tests Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 10 - 12 experiments and minimum 2 assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up and Assignments): 10 marks

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

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology Engineering	Semester : V
Course : Data Warehousing and Mining	Course Code: DJ19ITC503
Course : Data Warehousing and Mining Laboratory	Course Code: DJ19ITL503

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Knowledge of Database Management System

Course Objectives: This course emphasizes on 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 completion of the course, student should be able to:

1. Design a 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 a given raw data.
4. Apply appropriate data mining techniques on data sets to retrieve relevant information.
5. Work effectively as a member of the team.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Data Warehousing and Dimensional Modeling:** The Need for Data Warehousing, Definition of Data Warehouse, Benefits of Data Warehousing, Data Warehouse Architectures, Data Warehouse and Data Marts, Data Warehousing Design Strategies. Dimension Modeling: Dimensional Model vs Entity Relationship Model, Facts and Dimensions, Different types of keys, The Star Schema, The Snowflake Schema, Factless Fact Table, Updates to Dimension Tables, Fact Constellation Schema or Families of Star. Extraction Transformation Loading (ETL): Major steps in ETL Process, Challenges in ETL functions, Data Extraction and its types, Data Transformation and different tasks involved in transformation, Different techniques of data loading.	08
2	**Online Analytical Processing (OLAP):** Need for Online Analytical Processing, OLTP vs OLAP, OLAP Operations in a cube: Roll-up, Drilldown, Slice, Dice, Pivot. OLAP Models: MOLAP, ROLAP, HOLAP.	04
3	**Introduction to Data Mining, Data Exploration and Data Pre-processing:** What is Data	08

	Mining, kind of patterns to be mined, technologies used, major issues in Data Mining. Types of Attributes, Statistical Description of Data, Data Visualization, Measuring similarity and dissimilarity. Need for Pre-processing, Data Cleaning, Data Integration, Data Reduction: Attribute subset selection, Histograms, Clustering and Sampling, Data Transformation & Data Discretization: Normalization, Binning.	
4	**Classification:** Basic Concepts, Classification methods: 1. Decision Tree Induction: Attribute Selection Measures, Tree pruning. 2. Bayesian Classification - Naïve Bayes Classifier. Prediction - Structure of regression models; Simple linear regression, Multiple linear regression. Accuracy and Error measures, Precision, Recall, Holdout, Random Sampling, Cross Validation.	**07**
5	**Clustering:** Cluster Analysis - Basic Concepts, Partitioning Methods: K-Means, K-Mediods, Hierarchical Methods - Agglomerative, Divisive, BIRCH, Density-Based Methods – DBSCAN. What are outliers? Types, Challenges; Outlier Detection Methods: Supervised, Semi Supervised, Unsupervised, Proximity based, Clustering Based.	**09**
6	**Frequent Pattern Mining:** Market Basket Analysis, Frequent Itemsets, Closed Itemsets, and Association Rules, Frequent Pattern Mining, The Apriori Algorithm, Improving the Efficiency of Apriori - A pattern growth approach for mining Frequent Itemsets, Introduction to Mining Multilevel Association Rules and Multidimensional Association Rules, From Association Mining to Correlation Analysis (lift).	**06**

List of Laboratory Experiments:

1. Identify the real-world problem statement along with its raw data for a data warehouse.
2. Design the data warehouse model using star schema and snowflake schema.
3. To work on ETL tool to understand the various operations performed on raw data and transform it to the form suitable for loading into data warehouse.
4. Construction of OLAP Cubes and apply OLAP Operations to analyse the data for strategic decisions.
5. Exploratory data analysis using Python.
6. Data preprocessing using Python / R.
7. Using open-source tools to implement Classifiers.
8. Using open-source tools to implement Clustering algorithms.
9. Using open-source tools to implement Association Mining algorithms.
10. Implementation of classification, clustering and association mining algorithms using Java/ Python.
    a. Implementation of any one classifier using languages like JAVA/ Python/R.
    b. Implementation of any one clustering algorithm using languages like JAVA/ Python.
    c. Implementation of any one association mining algorithm using languages like JAVA/ Python.
11. **Mini Project:** Each group must be assigned a case study for which a report must be prepared outlining the following steps:
    a. Problem definition, identifying which data mining task is needed.
    b. Identify and use a standard data mining dataset available for the problem. Some links for data mining datasets are: WEKA site, UCI Machine Learning Repository, KDD site, KDD Cup etc.
    c. Implement the data mining algorithms.
    d. Visualize the results.

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

Books Recommended:

Text books:

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.

Reference Books:

1. Ralph Kimball, Margy Ross, "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling", 3rd Edition, Wiley India, 2013.
2. Thomas M. Connolly Carolyn Begg, "Database Systems: A Practical Approach to Design, Implementation and Management", 4th Edition, Pearson Ltd, 2015.
3. Michael Berry and Gordon Linoff, "Data Mining Techniques", 2nd Edition, Wiley Publications, 2004.
4. Vikram Pudi & Radha Krishna, "Data Mining", 1st Edition, Oxford Higher Education, 2009.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Consisting of Two Compulsory Class Tests: Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of atleast 10 experiments based on the above list.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments, Write-up): 15 Marks
ii. Journal Documentation (Write-up, Power Point Presentation and Assignments): 10 marks

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

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology Engineering	Semester : V
Course : Artificial Intelligence	Course Code: DJ19ITC504
Course : Artificial Intelligence Laboratory	Course Code: DJ19ITL504

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Knowledge of

1. Knowledge of any programming language
2. Data Structures

Course Objectives: To create thorough understanding of AI basics and real-time applications in its sub-domains. The course explores AI techniques like informed, uninformed and adversarial searching to solve real-life problems in a state space tree representation. The course also acquaints learner to advance topics of AI such as planning, handling uncertainty, natural language processing.

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

1. Solve the problem using appropriate AI techniques.
2. Apply NLP techniques on domain specific problems.
3. Work effectively as a member of the team.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Intelligent Systems and Intelligent Agents:** Introduction to AI, Components of AI, AI Problems and AI Techniques, solving problems by searching, Problem Formulation, State Space Representation, Applications of AI. **AI Domains:** NLP, ML, Deep Learning, Data Science, Cognitive Science. **Intelligent Agents:** Structure of Intelligent agents, Types of Agents, Agent Environments PEAS representation for an Agent.	06
2	**Problem-solving through Search:** **Uninformed Search** DFS, BFS, Uniform cost search, Depth Limited Search, Iterative Deepening. **Informed Search:** Heuristic functions, Hill Climbing, Simulated Annealing, Best First Search, A* **Constraint Satisfaction Problems**: Crypto Arithmetic, Map Coloring, N-Queens. **Adversarial Search:** Game Playing, Min-Max Search, Alpha Beta Pruning	10

3	**Knowledge Representation and Inference:** A Knowledge Based Agent, Knowledge representation technique: Logical Representation, Semantic Network Representation Frame Representation, Production Rules. Overview of Propositional Logic, First Order Predicate Logic, Inference in First Order Predicate Logic: Forward and Backward Chaining, Resolution.	**10**
4	**Planning:** Introduction to Planning, Planning with State Space Search, Partial Ordered planning, Hierarchical Planning, Conditional Planning.	**04**
5	**Uncertain Knowledge and Reasoning:** Uncertainty, Representing Knowledge in an Uncertain Domain, Conditional Probability, Joint Probability, Concept of Entropy, Bayes' theorem, Belief Networks, Simple Inference in Belief Networks.	**06**
6	**Natural Language Processing:** **Introduction:** Language Models, Natural Language for Communication: Syntactic Analysis, Augmented Grammars and Semantic Interpretation. **Handling Text Data**: Bag-of-words, Regular Expressions, Sentence Splitting and Tokenization, Punctuations and Stop words, Incorrect spellings, Properties of words and Word cloud Lemmatization and Term-Document TxD computation (TFIDF).	**04**

List of Laboratory Experiments:

1. Tutorial exercise for
   a. Design of Intelligent System using PEAS.
   b. Problem Definition with State Space Representation
2. Implement Breadth first search and depth first search.
3. Implement depth limited search and iterative deepening depth first search first search.
4. Implement Hill climbing algorithm.
5. Implement Best first search algorithm.
6. Implement A* algorithm
7. Implement examples of Predicate Logic, for forward and backward reasoning and resolution using prolog.
8. Read a Text and perform preprocessing activities on the text like removal of stop words, tokenization using NLTK and SPACY., Categorizing and Tagging Words
9. Text Classification using scikit-learn, python and NLTK.
10. Experiment on word cloud (data visualization –wordle)

ASSIGNMENTS:

Assignment 1(any1)

Case Study 1: Churn Analysis and Prediction (Survival Modelling) Cox-proportional models, Churn Prediction

Case Study 2: Credit card Fraud Analysis Imbalanced Data, Neural Network

Case Study 3: Sentiment Analysis or Topic Mining from New York Times Similarity measures (Cosine Similarity, Chi-Square, N Grams), Part-of-Speech Tagging, Stemming and Chunking

Case Study 4: Sales Funnel Analysis A/B testing, Campaign effectiveness, Web page layout effectiveness Scoring and Ranking.

Case Study 5: Recommendation Systems and Collaborative filtering User based, Item Based, Singular value decomposition–based recommenders.

Case Study 6: Customer Segmentation and Value Segmentation Strategies, Lifetime Value

Case Study 7: Portfolio Risk Conformance Risk Profiling, Portfolio Optimization.

Case Study 8: Uber Alternative Routing, Graph Construction, Route Optimization

Assignment 2: Presentation on comparative study of various techniques/ methodologies used for the case study selected.

Assignment 3: Solving Real Time CSP using techniques to improve efficiency of back propagation.
Assignment 4: Perform Sentiment Analysis on any social media dataset.

Books Recommended:

Text books:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 2nd Edition, Pearson Education, 2010.
2. Elaine Rich, Kevin Knight, Shivshankar B Nair, "Artificial Intelligence", 3rd Edition, McGraw Hill, 2017.
3. Judith S. Hurwitz, Marcia Kaufman, Adrian Bowles, "Cognitive Computing and Big Data Analytics", 1st Edition, Wiley India, 2015.

Reference Books:

1. George Lugar, "AI-Structures and Strategies for Complex Problem Solving", 4th Edition, Pearson Education 2002.
2. Nils J. Nilsson, "Principles of Artificial Intelligence", Narosa Publication, 1982.
3. Patrick H. Winston, "Artificial Intelligence", 3rd Edition, Pearson Education, 1992.
4. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Publication, 2013.
5. John Kelly, Steve Hamm, "Smart Machines - IBM′s Watson and the Era of Cognitive Computing", Columbia Business School Publishing, 2013.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practical's performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Consisting of Two Compulsory Class Tests: Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test. Total duration allotted for writing each of the paper is 1 hr.
2. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 10 to 12 experiments, and minimum 2 assignments. The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up, Power Point Presentation and Assignments: 10 marks

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

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology Engineering	Semester : V
Course : Professional and Business Communication Laboratory	Course Code: DJ19ITC505

<table>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td colspan="8">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="3">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td></tr>
<tr><td colspan="3">--</td><td>--</td><td>--</td><td>--</td><td rowspan="3">50</td></tr>
<tr><td colspan="3">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="2">Total Term work</td></tr>
<tr><td>--</td><td>4*</td><td>--</td><td>4</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td>Tutorial / Mini project / presentation/ Journal</td></tr>
<tr><td colspan="4"></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>50</td></tr>
</table>

*2 hrs. Theory (Class wise) and 2 hrs. Tutorial (Batch wise)

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 presentation skills.
4. To hone written skills for technical documentation.

Course Outcomes: On completion of the course, student should be able to:
1. Plan, organize and write technical documents like reports, proposals and research papers in the prescribed format using appropriate language and style with an understanding of ethics in written communication.
2. Apply techniques of writing resume, participating in a group discussion and facing interviews.
3. Develop interpersonal skills in professional and personal situations.
4. Understand the documentation process of meetings and conduct meetings in a professional manner.
5. Understand communication across cultures and work ethics.
6. Design and deliver effective presentations using Power Point.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
	Unit 1: Technical Writing	
	Report Writing: Types of report, parts of formal report, collection of data and survey analysis, pre-writing of report, language and style in reports, formatting of reports, referencing in report **Proposal Writing: Types** of technical proposals, format of proposal, language and style, presentation of proposal **Technical Paper Writing:** Parts of a technical paper, language and formatting, referencing in IEEE format	**08**

	Plagiarism: Types of plagiarism, consequences of plagiarism	
Unit 2: Employment Skills		
	Group Discussion: Purpose of a GD, types of GD, criteria for evaluating a GD, Dos and Don'ts of a GD, Tips to be successful in GD **Cover Letter & Resume Writing:** Format and content of cover letter, types of resume, 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	**06**
Unit 3: 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 team work, 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**
Unit 4: Meetings and Documentation		
	Planning and preparation for meetings, strategies for conducting effective meetings, notice, agenda and minutes of a meeting, business meeting etiquettes	**02**
Unit 5: Cross-cultural communication and Ethics		
	Communication across cultures, professional and work ethics, responsible use of social media, introduction to Intellectual Property Rights	**03**
Unit 6: Presentation Skills		
	Presentation strategies, overcoming stage fear, techniques to prepare effective PowerPoint presentation	**02**

List of Assignments

1. Business Proposal (PowerPoint presentation)
2. Resume writing
3. Interpersonal Skills (documentation of activity)
4. Meetings and Documentation (Notice, Agenda, Minutes of Mock Meetings)
5. Business ethics
6. Presentation Skills

Books Recommended:

Reference Books

1. Fred Luthans, *"Organizational Behavior",* McGraw Hill, Edition
2. Lesiker and Petit, *"Report Writing for Business",* McGraw Hill, Edition
3. Huckin and Olsen, *"Technical Writing and Professional Communication",* McGraw Hill
4. Wallace and Masters, *"Personal Development for Life and Work",* 12th Edition, Thomson Learning.
5. Heta Murphy*, "Effective Business Communication",* Mc Graw Hill, Edition
6. Sharma R.C. and Krishna Mohan, *"Business Correspondence and Report Writing",* Tata McGraw-Hill Education.
7. Ghosh, B. N., *"Managing Soft Skills for Personality Development",* Tata McGraw Hill. Lehman,
8. Bell, Smith, "Management Communication", 3rd Edition, Wiley India Edition.

9. Dr. Alex, K.," Soft Skills", S Chand and Company
10. Subramaniam, R., "Professional Ethics" Oxford University Press.

Evaluation Scheme:

Laboratory: (Term work)

Term work shall consist of 6 assignments, Group Discussion and Power Point Presentation based on the written report

The distribution of marks for term work shall be as follows:

i. Assignments: 15 Marks
ii. Project Report and Presentation: 15 Marks
iii. Group Discussion: 10 Marks

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

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology Engineering	Semester : V
Course : Microcontrollers and Embedded Systems	Course Code:DJ19ITEC5011
Course : Microcontrollers and Embedded Systems Laboratory	Course Code: DJ19ITEL5011

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

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 difference between microprocessor 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 completion of the course, student should be able to:

1. Write assembly program for 8051
2. Write assembly program for ARM 7.
3. Design interfacing for 8051 microcontroller.
4. Prioritize tasks in a real-time system using appropriate scheduling algorithms.
5. Develop solutions for real world problems using appropriate embedded boards.

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	**04**
3	**ARM 7 Architecture:** Architectural Inheritance, Data Path Design, Flag Register / CPSR, SPSR, Mode Bits, Condition Flags, Programmer's Model, Pipelining, Operating Modes: User,	**06**

	FIQ, IRQ, Supervisor, Abort, Undefined, System mode	
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	**06**
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	**02**

Suggested Lab Experiments (Any 4 from 8051, any 4 from ARM, 2 expts 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 digit 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 numbers
11. Loops (Series addition, largest, smallest, etc)
12. Multiplication and Divison 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", 2nd Edition, Pearson, 2007
2. Dr. K.V. K. K. Prasad., "Embedded / Real–Time Systems: Concepts, Design & Programming Black Book", Dreamtech Press, Reprint Edition 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", Third Impression, Pearson, 2013
2. Steve Furber, "ARM System on chip Architecture", 2nd Edition, Pearson, 2015
3. Raj Kamal, "Embedded Systems- Architecture, Programming and Design", 3rd Edition, 2017

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. An oral examination is to be conducted on the above syllabus and list of experiments.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each is to be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall be evaluated based on: laboratory work, journal and minimum two assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (implementation of experiments as suggested by faculty): 15 marks
ii. Journal Documentation (Write-up and Assignments): 10 marks

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

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology Engineering	Semester : V
Course : Human Computer Interaction	Course Code: DJ19ITEC5012
Course : Human Computer Interaction Laboratory	Course Code: DJ19ITEL5012

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work			
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	Total Term work	50
				25	--	--	15	10	25	

Pre-requisite: Knowledge of Web Programming

Course Objectives: The objective of the course is to introduce various user interface design methods. The course also covers various user interface evaluation techniques and empirical research methods.

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

1. Develop user interface using appropriate HCI design principles.
2. Evaluate user interface design.
3. Perform empirical research.
4. Work effectively as a member of the team.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to HCI**: Good and poor design, what to design? Historical evolution of the field, What is interaction design? The makeup of interaction, Multi-disciplinary design perspectives in HCI, The goals of interaction design, Usability goals, User experience goals, Design and usability principles, Heuristics and usability principles.	03
2	**Understanding User**s: Types of users and personas, Input-Output channels, Cognitive psychology – Visual perception, Memory, Thinking, Emotions, Mental model and User model, Individual differences, Psychology and the design of interactive system **Understanding Interaction:** What is interaction? Models of interaction, Ergonomics, Interaction styles: Menus, Windows, Device-based and Screen-based Controls	08
3	**Design Process:** Interaction Design Basics: What is design? User-centered design, Participatory design, Scenario based design, Navigation design, Screen design and Layout, Iteration & Prototyping Service design, designing mobile interfaces, Design Guidelines: Schneiderman's eight golden rules – Norman's seven principles, Gesalt principles.	08

4	**Model-based Design and Implementation** **Model based Design**: Basic idea, introduction to different types of models, GOMS family of models (KLM and CMN-GOMS) - Fitts' law and Hick-Hyman's law- Model-based design case studies. **HCI In The Software Process Implementation** HCI in the software process: The software life cycle, Usability engineering, Iterative design and prototyping	**08**
5	**Evaluation**: Overview of Evaluation methods Evaluation through expert analysis – Cognitive walkthrough, Nielsen's ten heuristics with example of its use -Heuristic evaluation, Evaluation through user participation – Experiments, Observation, monitoring physiological responses Choosing an evaluation method **Empirical research methods in HCI:** Introduction (motivation, issues, research question formulation techniques) – Experiment design and data analysis (with explanation of one-way ANOVA) – Hierarchical task analysis (HTA) – Engineering task models and Concur Task Tree (CTT)	**07**
6	**Accessibility:** Introduction, Key areas for consideration, planning for accessibility of a website, Technologies facilitate accessibility, Accessibility testing tools **Compliance with GIGW** **HCI in Business and Next Generation HCI:** HCI in Business – Introduction, How HCI can benefit business Next Generation HCI: - Introduction to Emergent paradigms: Groupware systems, Ubiquitous computing, Virtual & Augmented Reality, Affective computing, Context aware interfaces - Introduction to incorporating Design Thinking in HCI design practices.	**08**

List of Laboratory Experiments:

Instructions for Mini Project

1. The case study of User Interface design must be designed as a mini project work which is to be conducted by a group of three students
2. Each group will be associated with a subject in charge/ mini project mentor. The group should meet with the concerned faculty during Laboratory hours and the progress of work discussed must be documented.
3. The student must divide the task into different module
4. The student must understand the user requirements for each module
5. The student must do layout design following various design principles for each module
6. The student must do color and control design for each module
7. The student should start coding and testing of each module
8. The student must integrate design interface of each module
9. A detailed project report is to be prepared as per guidelines given by the concerned faculty.

Books Recommended:

Textbooks:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russel Beale, "Human–Computer Interaction", Pearson, 2009.
2. Rogers Sharp Preece, "Interaction Design: Beyond Human Computer Interaction", 5th Edition, Wiley, 2019.
3. Kalbande Dhananjay R, Kanade P., Iyer S., Galitz's, "Human Machine Interaction", Wiley Publications, 2015.

Reference Books:

1. Jeff Johnson, "Designing with the mind in mind", 2nd Edition, Morgan Kaufmann Publication, 2014.
2. Brian Fling, "Mobile Design and Development", 1st Edition, O'Reilly Media Inc., 2009.
3. Wilbert O. Galitz, "The Essential Guide to User Interface Design", Wiley publication, 2002.

Web Recourses:

1. https://nptel.ac.in/courses/106/103/106103115/

2. https://www.interaction-design.org/literature/article/accessibility-usability-for-all#:~:text=Accessibility%20is%20simply%20a%20function,for%20accessibility%20takes%20some%20forethought

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. An oral examination is to be conducted on the above syllabus and list of experiments.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each is to be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall be evaluated based on: laboratory work, journal and minimum two assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (implementation of experiments as suggested by faculty): 15 marks
ii. Journal Documentation (Write-up and Assignments): 10 marks

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

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology Engineering	Semester : V
Course : Statistical Analysis	Course Code: DJ19ITEC5013
Course : Statistical Analysis Laboratory	Course Code: DJ19ITEL5013

<table>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td colspan="8">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="4">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td></tr>
<tr><td colspan="4">75</td><td>25</td><td>25</td><td>25</td><td>100</td></tr>
<tr><td colspan="4">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="3">Total Term work</td><td rowspan="3">50</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">2</td><td rowspan="2">--</td><td rowspan="2">4</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td>Tutorial / Mini project / presentation/ Journal</td></tr>
<tr><td>25</td><td>--</td><td>--</td><td>15</td><td>10</td><td>25</td></tr>
</table>

Pre-requisite: Basic knowledge of statistics.

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

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

1. Summarize data using suitable diagrams.
2. Perform Test of Hypothesis based on independence.
3. Perform test of hypothesis for goodness of fit.
4. Estimate confidence interval for a population parameter.
5. Estimate relationship between two or more variables using appropriate model.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Statistical Analysis:** Introduction, Meaning of Statistics, The Scientific Method, Basic Steps of the Research Process, Experimental Data and Survey Data, Populations and Samples, Census and Sampling Method, Parameter and Statistic, Independent and Dependent Variables, Examining Relationships, Introduction to SPSS Statistics.	**06**
2	**Modeling Data:** Types of Data, Data Transformation, Summarizing Data: Graphical Methods, Summarizing Data: Measures of Central Tendency, Summarizing Data: Measures of Dispersion (mean, mode, standard deviation, range, IQR), Levels of Measurement, Random Variables and Probability Distributions, Discrete and Continuous Random Variable, Making Inferences about Populations from samples, Analysis of Enumerated data, Estimator and Estimate	**04**
3	**Hypothesis Testing:** Introduction, Null and Alternative Hypothesis, Type I and Type II Error, The Procedure of Hypothesis Testing, Hypothesis Testing of a • Population Mean: Large Sample, Confidence Interval for Population Mean Small Sample, F-	**10**

	test • Proportion (One Sample) • Population Variance • Population Mean: Two Independent Samples(), Dependent Samples (Paired Samples) • Hypothesis Test about Two Population Proportion, Variances	
4	**Analysis of Variance:** ANOVA/MANOVA: Chi-Square as a test of independent, Chi-square as a Test of goodness of fit: Testing the Appropriateness of a Distribution, Analysis of Variance, Multivariate analysis of variance, Likelihood.	**06**
5	**Regression Models:** Concept of Training set with hypothesis, Least squares and linear regression: Introduction; Joint Distributions: correlation and independence Notation; Ordinary least squares; Regression to the mean; Linear regression; Logistic regression, Residuals; Regression inference , Line of regression, Multivariable regression: Multivariate regression; Multivariate examples; Adjustment; Residual variation and diagnostics; Multiple variables, Interaction Terms, Non-linear Transformations of the Predictors, Qualitative Predictors, Multiple Regression Analysis: The Problem of Estimation and the Problem of Inference, Dummy Variable Regression Models, Multi-collinearity, Heteroscedasticity, Autocorrelation, Model Specification and Diagnostic Testing for Information Technology, Correlation and Covariance Analysis, Canonical Analysis, Canonical Roots/variates, Cluster Analysis: Measures of Association for Continuous Variables, Measures of Association for Binary Variables, Agglomerative Hierarchical Clustering, Ward's Method , Random Effects Model, Randomized Block Design: purpose, inference	**12**
6	**Extension of regression analysis:** Ridge Regression, The Lasso Nonlinear Regression Models: Approaches to Estimating Nonlinear , Generalized linear models: Logistic Regression, Binary outcomes, Count outcomes, Multiple Logistic Regression	**04**

List of Laboratory Experiments:

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

1. To calculate the mean, mode, standard deviation, range, IQR of sample through R.
2. To calculate Standard Errors.
3. To calculate point and interval estimate of the population proportion.
4. To obtain the confidence interval and parameter estimation.
5. To obtain Population Mean for Large Sample and Confidence Interval for Population Mean Small Sample
6. To compute F-test.
7. To implement Chi-square test of independence.
8. To implement Chi-square test of goodness of fit.
9. To implement Linear Regression.
10. To implement Multivariable regression.
11. To implement Lasso Nonlinear Regression.
12. To implement Logistic Regression.
13. To implement Multiple Logistic Regression.

Please Note: All experiments to be performed using R.

Books Recommended:

Text books:

1. Gupta, S. P, "Statistical Methods", Sultan Chand & Sons, 2021.
2. Hair, Black, Babin, Anderson and Tatham, " Multivariate Data Analysis: A Global Perspective", Global Edition, Pearson Education, 2010.
3. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, "An Introduction to Statistical learning with Applications in R.(2014)", Springer Science Business Media, New York.

Reference Books:

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

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral and practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester. Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test. Total duration allotted for writing each of the paper is 1 hr.
2. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term Work shall consist of at least 10 practical's based on the above list.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments, Write-up): 15 Marks
ii. Mini Project: 10 marks

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

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology							Semester : V			
Course : Innovative Product Development-III							Course Code: DJ19ILL1			
Teaching Scheme (Hours/week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				--			--	--	--	--
				Laboratory Examination			Termwork		Total Term work	50
--	02	--	01	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	--	--	25	

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 conceptualise and create a successful product.

Course Outcomes: On completion of the 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 conceptualising 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 analyse 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 organisations 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.

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology	Semester : VI
Course : Parallel and Distributed Computing	Course Code: DJ19ITC601
Course : Parallel and Distributed Computing Laboratory	Course Code: DJ19ITL601

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	150
				Laboratory Examination			Term work		Total Term work	
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Knowledge of Computer Networks and Operating System

Course Objectives: The objective of this course is to introduce the fundamentals of parallel and distributed computing that includes system architecture, programming model, design & implementation and performance analysis of these systems. The course also introduces concepts related to message passing interface, GPU, multithreaded programming and cloud computing.

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

1. Develop parallel computing solutions to a given problem.
2. Develop distributed applications.
3. Suggest appropriate cloud computing solutions.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Parallel Processing Architecture:** Introduction to Parallel Processing, Parallelism in sequential machines, Abstract model of Parallel computer, multiprocessor architecture, pipelining, array processors, Flynn's Taxonomy, Instruction Level support for parallel programming, Multiprocessor caches and Cache Coherence, Non-Uniform Memory Access (NUMA).	04
2	**Parallel Programming:** Data Dependency Analysis: Types of Dependencies, Loop and Array Dependence, Loop Dependence Analysis, Shared Memory Programming, General model of Shared Memory Programming: Process Creation, Mutual Exclusion, Examples, General model of Shared Memory Programming, Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations, MPI: Message Passing Interface Section, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and	08

	Communicators, OpenMP: Standard for Directive Based Parallel Programming, Dense Matrix Algorithms: Matrix-Matrix Multiplication, Solving a System of Linear Equations.	
3	**GPU Architecture and Programming:** GPU architecture, parallel algorithm design, data parallelism, CUDA (Compute Unified Device Architecture): A general purpose parallel computing architecture, kernel, thread organization, memories hierarchy, heterogeneous programming, Introduction to CUDA Programming. **Performance Measures:** Performance Measures: Speedup, execution time, efficiency, cost, scalability, Effect of granularity on performance, Scalability of Parallel Systems, Amdahl's Law, Gustafson's Law, Performance Bottlenecks.	**07**
4	**Introduction to Distributed Computing:** Definition of Distributed Computing, Goals of Distributed Computing, Distributed Computing Models, Software Concepts, and Issues in designing Distributed System, Multithreading, Clock Synchronization, Physical and Logical Clocks, Global State, Election Algorithms, Mutual Exclusion, Distributed Transactions, Deadlocks. Difference between distributed and parallel architectures and examples of both.	**07**
5	**Communication:** Message Passing, Introduction to Message Passing, Advantages and features of Message Passing, Message Format, Message Buffering, Multi Data gram Messaging, Group Communication. Remote Procedure Call (RPC): Basic RPC Operations, Parameter Passing. Remote Object Invocation: Distributed Objects, binding a Client to an Object, Static Vs Dynamic RMI, Parameter Passing, Java RMI. Message Oriented Communication: Persistence and synchronicity in communication, Message Oriented Transient and Persistent Communications.	**08**
6	**Cloud Computing and Virtualization:** Cloud Computing definition, Components of Cloud Computing, Cloud types: NIST and Cloud Cube Models, Cloud Deployment Models and Service Models, Cloud Computing architecture, Advantages and Disadvantages of Cloud Computing, High Performance Cloud Computing (HPC2). Virtualization: Characteristics of virtualized environment, Type I & Type II Hypervisors, Taxonomy of virtualization, Implementation Levels of Virtualization, Virtualization of CPU, Memory and I/O Devices, Technology Examples: KVM, Xen, Vmware and HyperV. Exploring the Components of Amazon Web Services such as EC2, S3, EBS, etc.	**08**

List of Experiments:

1. Basics of MPI (Message Passing Interface)
2. Implementation of advanced MPI Programs
3. Basics of OpenMP API
4. Shared Memory Programming using OpenMP API
5. Setting up CUDA Development Environment
6. Programming in CUDA
    a. Matrix Multiplication
    b. Parallel Sort
7. Creating distributed applications using RPC / RMI
8. Implementation of Election Algorithms
9. Implementation of Mutual Exclusion Algorithms
10. Implementation of SaaS, PaaS and IaaS using AWS
11. Basics Programs using Go Language
12. Concurrent Programming using Go routines
13. Concurrent Programming using Go channels
14. Basics Programs using Julia Language

15. Concurrent Programming using Julia
16. Implementation of Julia Ecosystem

Books Recommended:

Text books:

1. M. Sasikumar, Dinesh Shikhare and P. Ravi Prakash, "Introduction to Parallel Processing", 2nd Edition, PHI, 2014.
2. Sunita Mahajan, Seema Shah, "Distributed Computing", 2nd Edition, Oxford, 2010.
3. Andrew S. Tanenbaum & Maarten van Steen "Distributed Systems: Principles and Paradigms" Prentice Hall of India Private Limited.
4. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, "Introduction to Parallel Computing", 2nd Edition, Pearson Education, 2007.
5. Kai Hwang, Naresh Jotwani, "Advanced Computer Architecture: Parallelism, Scalability, Programmability", 2nd Edition, McGraw Hill, 2010.
6. Edward Kandrot and Jason Sanders, "CUDA by Example – An Introduction to General Purpose GPU Programming", Addison-Wesley Professional, 2010.
7. Benedict R Gaster, Lee Howes, David R Kaeli, Perhaad Mistry, Dana Schaa, "Heterogeneous Computing with OpenCL", 2nd Edition, Elsevier, 2013.

Reference Books:

1. Pradeep K. Sinha "Distributed Operating Systems", Prentice Hall of India Private Limited, 2012
2. Georg Hager, Gerhard Wellein, "Introduction to High Performance Computing for Scientists and Engineers", Chapman & Hall / CRC Computational Science series, 2011.
3. Michael J. Quinn, "Parallel Programming in C with MPI and OpenMP", McGraw-Hill International Editions, Computer Science Series, 2008.
4. Kai Hwang, Zhiwei Xu, "Scalable Parallel Computing: Technology, Architecture, Programming", McGraw Hill, 1998.
5. Laurence T. Yang, MinyiGuo, "High- Performance Computing: Paradigm and Infrastructure" Wiley, 2006.

Web Resources

1. Introduction to Parallel Computing from Livermore Computing
2. Links to Parallel and Network Programming Resources MPI, OpenMP, posix threads, socket programming, CUDA...
3. Some Cluster and Distributed Systems Papers
4. https://golang.org/
5. https://golang.org/doc/tutorial/
6. https://golang.org/doc/tutorial/getting-started
7. https://levelup.gitconnected.com/goroutines-and-channels-concurrent-programming-in-go-9f9f8495c34d
8. https://docs.julialang.org/en/v1/
9. https://julialang.org/learning/tutorials/

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Weightage of each module in end semester examination is expected to be/will be proportional to number of

respective lecture hours mentioned in the syllabus.

3. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Consisting of **Two Compulsory Class Tests** Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of atleast 10 experiments based on the above list.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments, Write-up): 15 Marks

ii. Journal Documentation (Write-up, Power Point Presentation and Assignments): 10 marks

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

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology	Semester : VI
Course : Software Engineering	Course Code: DJ19ITC602
Course : Software Engineering Laboratory	Course Code: DJ19ITL602

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

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 completion of the course, student should be able to:

1. Select suitable software development lifecycle model(s) for software development.
2. Analyze real world problem using software engineering principles.
3. Work effectively as a member of the team.

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.	04
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,	12

	Interface Design, Component level Design: Designing Class based components.	
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,	**10**
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 recommended SDLC model suitable for the system under development.
2. Perform detailed requirement analysis and develop Software Requirement Specification Sheet (SRS) as per IEEE format.
3. Design Data Flow Diagram (DFD) up-to level 2 & E-R Diagram for the proposed system.
4. Modeling the structural view for the system: Class diagram, object diagram.
5. Modeling the behavioral aspect for the system: UML Use Case Diagram, Sequence Diagram & Activity diagram.
6. 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.
7. Implementing Software Configuration Management process using Git, CVS, Bazaar etc.
8. Design test cases for testing the system under development and prepare test plan in IEEE format. Selenium tool.
9. Implementation of containerization (Create Basic HTML webpage/s and deploy web server) using Docker.
10. Demonstration of working of CICD pipeline (Continuous Integration and Continuous Deployment tools) e.g Jenkin.
11. Demonstration and Orchestration of Kubernet environment.

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

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.
3. Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management".

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 7 experiments, 1 Power Point Presentation and minimum 2 assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up, Power Point Presentation and Assignments: 10 marks

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

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology	Semester : VI
Course: Image Analysis And Computer Vision	Course Code: DJ19ITC603
Course: Image Analysis And Computer Vision Laboratory	Course Code: DJ19ITL603

<table>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td colspan="9">Evaluation Scheme</td></tr>
<tr><td colspan="3">Semester End Examination Marks (A)</td><td colspan="4">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="3">Theory</td><td>Term Test 1</td><td colspan="2">Term Test 2</td><td>Avg.</td></tr>
<tr><td colspan="3">75</td><td>25</td><td colspan="2">25</td><td>25</td><td>100</td></tr>
<tr><td colspan="3">Laboratory Examination</td><td colspan="4">Term work</td><td rowspan="3">Total Term work</td><td rowspan="3">50</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">2</td><td rowspan="2">--</td><td rowspan="2">4</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td colspan="2">Tutorial / Mini project / presentation/ Journal / Assignment</td></tr>
<tr><td>25</td><td>--</td><td>--</td><td>15</td><td colspan="2">10</td><td>25</td></tr>
</table>

Pre-requisite: Knowledge of

1. Any programming language
2. Data Structures
3. Math: Linear algebra, vector calculus and probability.

Course Objectives: To introduce computer vision fundamentals through image formation, feature detection & matching, image segmentation, stereo, motion estimation & tracking, image classification & scene understanding techniques and apply them to generate solutions for problem domains such as image analysis, emotion detection, gesture recognition, etc.

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

1. Describe fundamentals of computing on images.
2. Apply suitable processing techniques on image.
3. Apply motion analysis on real time problem
4. Build a computer vision application with team members to solve real-time problems.
5. Work effectively as a member of the team.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Digital Image Formation and representation:** Elements of Image Processing Systems, Imaging geometry, radiometry, digitization, cameras and projections. **Fundamentals of Image Formation**: Color models: RGB, HSV, YCbCr, CYB, Contrast and brightness correction, Color space conversion: color models to greyscale. Image Enhancement, Restoration, Histogram Processing. Filtering: convolution, smoothing, differencing, and scale space. Transformation: Fourier, Orthogonal, Euclidean, rigid, Affine, Projective.	06

	Introduction to computer vision: Vision for measurement, Vision for perception, interpretation, Visual search and organization.	
2	**Feature detection and Extraction**: Points and patches, Feature detectors, Feature descriptor, Feature matching, Feature tracking, Edges: Edge detection, Edge linking, Canny, LOG, DOG. Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT. Line detector: Successive approximation, Hough transforms, RANSAC, Vanishing points, corner detection, line and curve detection, active contours, shape context descriptors.	**07**
3	**Image segmentation:** Introduction, Region Growing, Edge Based approaches to segmentation, MRFs, Texture Segmentation, Object detection, Sliding windows, Detector training, Over segmentation. **Active contours:** Snakes, Dynamic snakes and CONDENSATION, Scissors, Level Sets (multiple objects in an image) Split and merge: Watershed, Region splitting (divisive clustering), Region merging (agglomerative clustering), Graph-based segmentation, Probabilistic aggregation, Mean shift and mode finding, K-means clustering (to break an image up into part) and mixtures of Gaussians, Mean-Shift, Normalized cuts, Graph-Cuts and energy-based methods.	**06**
4	**Deep learning models for image segmentation:** Neural networks Basics and Convolutional Networks (CNN), R-CNN, Fast R-CNN, Faster R-CNN. Human pose estimation as image segmentation, Style transfer, Generative adversarial networks, Image transformation with neural networks, Attentional cascades and neural networks, Region-based convolutional neural network, Semantic segmentation.	**06**
5	**Transfer Learning:** Introduction to Transfer Learning, Options in Transfer Learning, Transfer Learning with ResNet50, ResNet50 in code, Network architecture for Object Localization, Evaluating Object Localization, AlexNet, VGG and Inception architectures, Fine-grained image recognition, Detection and classification of facial attributes, Content-based image retrieval, Computing semantic image embeddings using convolutional neural networks, Employing indexing structures for efficient retrieval of semantic neighbors, The re-identification problem in computer vision Facial key points regression, CNN for key points regression.	**05**
6	**Motion Analysis and action recognition:** Introduction to motion analysis, Background Subtraction and Modeling **Optical Flow:** Dealing with the aperture problem: regularization, Horn and Shunck method: algorithm using discrete formulation, steps of Jacobi's method for matrix inversion, and comments about limitations, Lucas-Kanade algorithm for optical flow, Comparison of Horn-Shunck and Lucas-Kanade algorithms, Deep learning in optical flow estimation. **Feature Point Tracking:** Kanade-Lucas-Kanade tracker, Motion models: patch-wise translation and patch-wise affine, Concept of a good feature point based on saliency (like criteria in Lucas-Kanade optical flow algorithm). Tracking of salient feature points: using translation and affine models, Some results of KLT tracker, Introduction to action recognition, Action classification, Action classification with convolutional neural networks, Action localization. Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation. Visual object tracking methods and its examples, Concept and Examples of multiple objects tracking methods.	**10**

Mini project (suggested): Implement using OpenCV/Python libraries/TensorFlow.

1. Facial KeyPoint Detection, Face verification, Hybrid image formation, to incorporate facial expression classification and detection.
2. Image captioning
3. Headcount detection in enclosed spaces.
4. Visual question answering
5. Image grounding
6. Motion detection and feature point tracking, mosaicking, video stabilization, structure from motion
7. Inference of human activity from image sequences [drowsiness, GAIT, cerebral palsy]
8. Google art project
9. Pedestrian detectors.
10. Contour tracking and rotoscoping-incorporate angular analysis to track trajectory of an object.
11. Generate tabular data from image of paper-based form.
12. Identification of plants from leaves
13. Hand Gesture Recognition

List of Laboratory Experiments: (Any Seven)

1. Color Detection
2. Edge editing and enhancement
3. Learn about background subtraction for video.
4. Identify common objects (horizon, building, trees) from image.
5. Perform Face Detection on Your Family Photos
6. Image Colorization
7. Detecting Contours
8. Watermarking Images with OpenCV
9. Mini- project presentation.
10. Technical paper suitable for publication.

Books Recommended:

Textbooks:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer-Verlag London Limited 2011.
2. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003.
3. E.R. Davies, "Computer Vision: Principles, Algorithms, Applications, learning", 5th Edition 2017.

Reference Books:

1. "Programming Computer Vision With Python: Tools And Algorithms For Analyzing Images", O'reilly Publication 2012.
2. "Learning OpenCV Computer Vision with OpenCV library", O'reilly Publication 2008.
3. Benjamin Planche, Eliot Andres, "Hands-on Computer Vision with TensorFlow 2", Packt Publication, 2019.

Journals:

1. IEEE-T-PAMI (IEEE Transactions on Pattern Analysis and Machine Intelligence).
2. IJCV (International Journal of Computer Vision) - Springer.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice

as appropriate), each carrying 15 marks, total summing up to 75 marks.

2. Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in the syllabus.
3. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practical performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Consisting of **Two Compulsory Class Tests** Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 10 to 12 experiments, and minimum 2 assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Mini-Project: 10 Marks

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

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology	Semester : VI
Course: Internet of Things	Course Code: DJ19ITEC6011
Course: Internet of Things Laboratory	Course Code: DJ19ITEL6011

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

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 the 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 completion of the course, student should be able to:

1. Develop IoT applications using suitable enabler technologies.
2. Analyze IoT application data stored on cloud.
3. Work effectively as a member of the team.

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	03
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)	07
4	**Data Computing using Cloud Platform:** Data Acquisition and Storage, Data Categorization for Storage, Organizing the Data, Data Processing and Analytics (Descriptive, Predictive,	08

	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)	
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	**06**
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, Device Authentication.	**05**

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 survey for finalizing their mini project topic using Raspberry Pi / Arduino / ARM Cortex / Intel Galileo etc.
4. Each group 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:

Textbooks:

1. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, Mc Graw Hill.
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, 2014.
2. Dr. Ovidiu Vermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, 2013.
3. Vijay Madisetti, Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 2015.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. An oral examination will be conducted on the mini-project implemented by group of students.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester.
2. Total duration allotted for writing each paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall be evaluated based on: mini project implementation, detailed report, presentation and minimum two assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (mini project implementation and detailed report): 15 Marks
ii. Journal Documentation (Write-up, Power Point Presentation and Assignments): 10 marks

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

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology	Semester : VI
Course : UI/UX	Course Code: DJ19ITEC6012
Course : UI/UX Laboratory	Course Code: DJ19ITEL6012

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test1	Term Test2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work			
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal / Assignment	Total Term work	50
				25	--	--	15	10	25	

Pre-requisite: Knowledge of Web Programming, HCI.

Course Objectives: The objective of the course is to explore various user research methods and information architecture and to use them in interaction design, visual design and functional Layout Design. The course also introduces students to usability testing which is performed on various design.

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

1. Identify user requirements.
2. Design UI/UX using appropriate methods.
3. Generate test report using usability testing.
4. Work effectively as a member of the team.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction:** What is UX Design? What is UI Design? UX Design Deliverables, What is design and thinking and why it is so popular, The 5 Main Ingredients of UX: Psychology, Usability, Design, Copywriting & Analysis. Seven factors that influence user experience-useful, usable, findable, credible, desirable, accessible, valuable	04
2	**User Research:** What is UX research? What's the difference between good and bad UX research? What are the five steps of UX research? What's the role of research in the UX design process? What is the value of UX research? Seven Great, Tried and Tested UX Research Techniques: Card sorting, Expert review, Eye movement tracking, Field studies, Usability testing, Remote Usability Testing, User Personas. **Other Research Methods:** User Interviews, Observation, Focus group discussion, Survey Competitor analysis, Empathy mapping. **Information Architecture:** What is Information Architecture? User Stories & Types of	09

	Information Architecture: Categories, Tasks, Search, Time, People, What is a Wireframe?	
3	**Interaction Design:** Ideation Methods – Interaction, Wireframing and Prototyping, Paper Prototyping, Build your own Prototyping, Prototyping Tools For UI/UX Designers — How To Choose The Right One? Heuristic (Expert) Evaluation, Designing a Web / Mobile App	**08**
4	**Visual Design:** Web App UI Elements, Mobile App UI Elements, Grid Systems, Colors Theory and Palette, Understanding Typography – Material UI.	**08**
5	**Functional Layout Design:** Z-Pattern, F-Pattern, and Visual Hierarchy, Browsing vs. Searching vs. Discovery, Page Framework, The Fold, Images, & Headlines, The Axis of Interaction Forms, Calls-to-Action, Instructions & Labels, Primary & Secondary Buttons.	**07**
6	**Usability Testing:** Testing Methods - User Testing - A/B Testing - Conducting a Usability Test - Test Results Report	**06**

Laboratory Experiment (Mini Project):
Instructions for Mini Project:

Interaction Design	
Task1	Create the design via paper prototyping Apps
Task2	Build the own prototyping with Adobe XD
Task3	Designing the own Web / Mobile App
Visual Design Task1	Create and design the UI Elements
Task2	Implement all UI Elements in the Web App / Mobile App
Task3	Understand the Grid System and implement the Web App / Mobile App
Task4	Implement colors Theory and Typography in your own Web App/ Mobile App Through Material UI and other UI Kit
User Research Task1	Post personas with your image and collective information
Task2	Create the own idea with Empathy Mapping
Usability Testing Task1	Conduct a user testing and Usability testing
Task2	Submit the Test result report

Books Recommended:

Text books:

1. Donald Norman, "The Design of Everyday Things: Revised and Expanded Edition", Basic Books, 2013.
2. Rogers Sharp Peerce," Interaction Design: Beyond Human Computer Interaction", 5th Edition, Wiley, 2019.

Reference Books:

1. Jeff Johnson, "Designing with the mind in mind", 2nd Edition, Morgan Kaufmann Publication, 2014.
2. Alan Dix, Janet Finlay, Gregory Abowd, Russel Beale, "Human–Computer Interaction", Pearson, 2009.
3. Brian Fling, "Mobile Design and Development", First Edition , O"Reilly Media Inc., 2009.
4. Wilbert O. Galitz, "The Essential Guide to User Interface Design", Wiley publication, 2002.

Web Recourses:

1. https://thehipperelement.com/post/75476711614/ux-crash-course-31-fundamentals
2. https://uiuxtrend.com/user-experience-ux-process/
3. Introduction:

a. https://uxplanet.org/what-is-ui-vs-ux-design-and-the-difference-d9113f6612de
b. https://uxplanet.org/a-complete-list-of-ux-deliverables-d62ccf1de434
c. https://www.toptal.com/designers/ux/10-common-ux-deliverables
d. https://www.interaction-design.org/literature/article/what-is-design-thinking-and-why-is-it-so-popular
e. https://thehipperelement.com/post/72080847673/daily-ux-crash-course-3-of-31
f. https://www.interaction-design.org/literature/article/the-7-factors-that-influence-user-experience

4. User research:
    a. https://careerfoundry.com/en/blog/ux-design/how-to-conduct-user-experience-research-like-a-professional/
    b. https://www.interaction-design.org/literature/article/7-great-tried-and-tested-ux-research-techniques
5. Visual Design
    a. https://www.awwwards.com/understanding-web-ui-elements-principles.html
    b. https://blog.tubikstudio.com/mobile-ui-design-15-basic-types-of-screens/
    c. https://appsamurai.com/6-necessary-elements-for-designing-a-perfect-mobile-app-user-interface/
    d. https://www.smashingmagazine.com/2018/02/comprehensive-guide-to-mobile-app-design/
    e. https://www.mockplus.com/blog/post/ui-grid-layout-design#:~:text=Grids%20work%20as%20a%20framework,more%20consistent%20and%20appealing%20UIs.
    f. https://careerfoundry.com/en/blog/ui-design/introduction-to-color-theory-and-color-palettes/
    g. https://xd.adobe.com/ideas/process/ui-design/typography-in-ui-design/#:~:text=The%20role%20of%20typography%20in%20design&text=In%20order%20to%20be%20successful,create%20a%20great%20user%20experience.
    h. https://github.com/mui-org/material-ui
6. Interaction Design:
    a. https://www.interaction-design.org/literature/article/introduction-to-the-essential-ideation-techniques-which-are-the-heart-of-design-thinking
    b. https://www.smashingmagazine.com/2018/03/guide-wireframing-prototyping/
    c. https://medium.theuxblog.com/11-best-prototyping-tools-for-ui-ux-designers-how-to-choose-the-right-one-c5dc69720c47
    d. https://careerfoundry.com/en/blog/ux-design/what-is-a-heuristic-evaluation-in-ux/#:~:text=A%20heuristic%20evaluation%20is%20a,is%20evaluated%20by%20usability%20experts.
    e. https://designforfounders.com/web-app-ux/
    f. https://uxplanet.org/best-practices-in-mobile-app-design-in-2020-7f5026818ade
    g. https://www.toptal.com/designers/ux/mobile-ux-design-best-practices
7. Usability Testing:
    a. https://www.nngroup.com/articles/usability-testing-101/

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Consisting of Two Compulsory Class Tests: Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test. Total duration allotted

for writing each of the paper is 1 hr.

2. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 10 to 12 experiments, and minimum 2 assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks

ii. Journal Documentation (Write-up, Power Point Presentation and Assignments: 10 marks

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

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology	Semester : VI
Course : Big Data Analytics	Course Code: DJ19ITEC6013
Course : Big Data Analytics Laboratory	Course Code: DJ19ITEL6013

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

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 completion of the 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, Challenges of Conventional Systems - Intelligent data analysis Analytic Processes and Tools - Analysis vs Reporting. Traditional vs. Big Data business approach, Big Data Challenges, Big Data Applications (Examples of Big Data in Real Life)	03
2	**Hadoop and MapReduce:** Introduction to Hadoop, Hadoop components, Hadoop Distributed File System (HDFS) & Architecture, Core Hadoop Components, 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, SQL query operations	05
3	**Hadoop Ecosystem**: Introduction, 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 Big Data Analytics with Apache Spark & Scala: Introduction, Features, Spark built on Hadoop (Spark v/s Hadoop) Components of Spark, Introduction to Scala, Features of Scala, data types and literal	14

	used in Scala, Operators and methods used in Scala.	
4	**Mining Big Data Streams:** 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 Classification Algorithms: Parallel Decision trees, Overview SVM classifiers, Parallel SVM, KNearest Neighbor classifications for Big Data, One Nearest Neighbor.	**06**
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 - Network Graphs** - Social Networks as Graphs, Types, Clustering of Social Network Graphs.	**06**

List of Laboratory Experiments:

1. To set-up and Install Hadoop in its three operating modes:
    a. Standalone,
    b. Pseudo distributed,
    c. Fully distributed
2. Implement the following file management tasks in Hadoop:
    a. Adding files and directories
    b. Retrieving files
    c. Deleting files
3. To run a basic Word Count MapReduce program to understand MapReduce Paradigm
4. To implement Matrix 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. To perform NoSQL database using Mongo dB to create, update and insert.
8. 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:

Text books:

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. Hadoop: The Definitive Guide, 4th Edition, O'Reilly Media, Inc., 2015
4. Alex Holmes, "Hadoop in Practice", 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", Wiley Big Data Series, 2017.
2. Vignesh Prajapati, "Big Data Analytics with R and Hadoop", Packt Publishing Limited.
3. Tom White, "Hadoop: The Definitive Guide" , O'Reilly Publications,2016.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

1. Term work shall consist of minimum 7 experiments, 1 Power Point Presentation and minimum 2 assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up, Power Point Presentation and Assignments: 10 marks

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

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology	Semester : VI
Course : Soft Computing	Course Code: DJ19ITEC6014
Course : Soft Computing Laboratory	Course Code: DJ19ITEL6014

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Probability and Statistics, Python programming.

Course Objectives: To explore soft computing techniques like fuzzy logic, artificial neural network (ANN), genetic algorithms (GA) and study their applications. To familiarize with design of Hybrid systems developed using Fuzzy, ANN and GA.

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

1. Analyse a real-life problem.
2. Solve real-life problem using appropriate soft computing technique(s).

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Fuzzy Set Theory:** Fuzzy Sets: Basic definition and terminology, Basic concepts of fuzzy sets, Fuzzy set operations, Fuzzy relations: Cardinality of fuzzy relations, operations on fuzzy relations, properties of fuzzy relations, Fuzzy composition Fuzzification and Defuzzification: Features of the membership Functions, Fuzzification, Lambda-Cuts for Fuzzy Sets, Lambda-Cuts for Fuzzy Relations, Defuzzification methods.	05
2	**Fuzzy Rules, Reasoning, and Inference System:** Fuzzy Rules: Fuzzy If-Then Rules, Fuzzy Reasoning Fuzzy Inference System (FIS): Mamdani FIS, Sugeno-FIS, Comparison between, Mamdani and Sugeno-FIS.	05
3	**Neural Network-I:** Introduction: What is a Neural network? Fundamental Concepts, basic Models of Artificial Neural Networks, Artificial Intelligence and Neural Networks, McCulloch-Pitts Neuron. **Learning:** Error-Correction Learning, Memory based Learning, Hebbian learning, Competitive Learning, Boltzmann Learning. **Perceptron:** Perceptron Learning Rule, concept of linearly separable and non-separable sets, Perceptron Learning Algorithm, Perceptron Convergence Theorem, Perceptron learning and Non-	08

	separable sets.	
4	**Neural Networks -II:** Back propagation: Multi-layered Network Architecture, Back propagation Algorithm, Practical Consideration in Implementing the Back Propagation Algorithm. Back propagation and XOR problem. Adaptive resonance Theory: Noise-Saturation Dilemma, Solving the Noise-Saturation Dilemma, Recurrent On-center-Off-surround Networks, building blocks of Adaptive Resonance, Substrate of resonance, Structural details of the resonance Model, Adaptive Resonance Theory I (ARTI). Character Recognition: Introduction, General Algorithm Architecture for Character Recognition: Banalization, Pre-processing, Filters, Smoothing, Skew Detection and Correction, Slant Correction, Character Normalization, Thinning, Segmentation, Multilingual OCR by Rule-Based Approach and ANN. Rule-Based Approach: Classification, Tests, Rules Artificial Neural Network: Inputs, Outputs, Identification, Results of Multilingual OCR.	**10**
5	**Genetic Algorithm:** An Introduction to genetic Algorithms: A Simple Genetic Algorithm Stepwise execution of GA, semantics of GA. Implementation of a Genetic Algorithm: Data Structures, Reproduction, Crossover and Mutation, probabilities of crossover and mutation, Mapping Objective Functions to Fitness Form, Fitness Scaling, pseudocode of GA. Algorithm for Handwriting Recognition Using GA, Generation of Graph, Fitness Function of GA: Deviation between Two Edges, Deviation of a Graph, Crossover: Matching of Points, Generate Adjacency Matrix, Find Paths, Removing and Adding edges, Generation of Graph Results of Handwriting Recognition: Effect of Genetic Algorithms, Distance Optimization, Style Optimization.	**06**
6	**Hybrid Computing:** Introduction, Neuro-Fuzzy Hybrid Systems, Adaptive Neuro-Fuzzy Inference System (ANFIS): Introduction, ANFIS Architecture, Hybrid Learning Algorithm, ANFIS as a Universal Approximator, Simulation Examples: Two-input Sinc Function and Three Input Nonlinear Function. Genetic Neuro-Hybrid Systems: Properties of Genetic Neuro-Hybrid Systems, genetic Algorithm based Back-propagation Network, Advantages of Neuro- Genetic Hybrids, Genetic Fuzzy Hybrid and Fuzzy Genetic Hybrid Systems Genetic Fuzzy Rule based Systems, Advantages of Genetic Fuzzy Hybrids.	**08**

Experiment List:

1. Fuzzy membership function
2. Fuzzy Extension principle
3. Fuzzy controller
4. Perceptron Learning rule
5. Delta Learning Rule
6. Associative Memory
7. Genetic Algorithm
8. Competitive Learning

Books Recommended:

Text books:

1. S.N. Sivanandan and S.N. Deepa, Principles of Soft Computing, Wiley India, 2007, ISBN: 10: 81- 265-1075-7.
2. Jacek M. Zurada, "Introduction to Artificial Neural Systems," Jaico Publishing House, 1992.
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", 3rd Edition, Wiley India,2010

4. J.-S. R. Jang, C. –T. Sun, E. Mizutani, "Neuro-Fuzzy and Soft Computing, A Computational Approach to Learning and Machine Intelligence", PHI Learning PrivateLimited, 2014.
5. Satish Kumar, "Neural Networks: A Classroom Approach", Tata McGraw-Hill Education,2012
6. Simon Haykin, "Neural Networks A Comprehensive Foundation", 2nd Edition, Pearson Education, 2004
7. David E. Goldberg, "Genetic Algorithms, in search, optimization and Machine Learning", 13th Edition, Pearson, 1989.

Reference Books:

1. Anupam Shukla, Ritu Tiwari, Rahul Kala, "Real Life Applications of Soft Computing", CRCPress, Taylor & Francis Group, 2010.
2. Michael Affenzeller, Stephan Winkler, Stefan Wagner, and Andreas Beham, "Genetic Algorithms and Genetic Programming Modern Concepts and Practical Applications", CRCPress, 2009.
3. Laurene V. Fausett, "Fundamentals of Neural Networks: Architectures, Algorithms and Applications", 1st Edition Pearson Education India, (1 January 2004).

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75marks.
2. Total duration allotted for writing the paper is 3hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Consisting of Two Compulsory Class Tests: Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test. Total duration allotted for writing each of the paper is 1hr.
2. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

1. Term work shall consist of minimum 8 experiments and minimum 2 assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up) and Assignments: 10 marks

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

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology	Semester : VI
Course : Infrastructure Security	Course Code: DJ19ITEC6015
Course : Infrastructure Security Laboratory	Course Code: DJ19ITEL6015

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

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 completion of the course, student should be able to:

1. Evaluate the impact of cybersecurity threats for critical infrastructure protection.
2. Apply appropriate security policies and mitigation techniques for protecting the infrastructure components.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction:** 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.	**06**
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	**Wireless Security:** Mobile Device Security- Security Threats, Device Security, GSM, UMTS and 4G Security, IEEE 802.11xWireless LAN Security, VPN Security, Wireless Intrusion Detection System (WIDS).	**06**
4	**Cloud Security**: Cloud Security Risks and Countermeasures, Data Protection in Cloud, Cloud Application Security, Cloud Identity and Access Management, Cloud Security as a Service, SAML, OAuth.	**04**

5	**Web Security:** Web Security Considerations, User Authentication and Session Management, Cookies, SSL, HTTPS, SSH, Web Browser Attacks, Account Harvesting, Web Bugs, Click jacking, Cross- Site Request Forgery, Session Hijacking and Management, Phishing and Pharming Techniques, DNS Attacks, Web Service Security, Secure Electronic Transaction, Email Attacks, Web Server Security as per OWASP, Firewalls, Penetration Testing	**10**
6	**Business Continuity & Disaster Recovery Planning:** Risk Analysis and Management, Disaster Recovery & Business Continuity- BCPL, RPO, RTO Security Policies, Business Continuity Plan, , Incident Management, Ethical Issues in Security Management.	**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. Setting up personal Firewall using Iptables.
5. Exploring wireless security tools like Kismet, NetStumbler etc.
6. Performing a penetration testing using Metasploitable.
7. Exploring Router security, access lists using packet tracer.
8. Exploring VPN security using Packet tracer.
9. Exploring Authentication and access control using RADIUS, TACACS and TACACS+.
10. Install and use a security app on an Android mobile (e.g. Droidcrypt).
11. Explore forensics tools in Kali Linux for acquiring, analyzing and duplicating data.
12. Configuration of mod Security, core rule set on apache server.

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. Eric Cole, "Network Security Bible", 2nd Edition, Wiley, 2016.

Reference Books:

1. "Web Application Hackers Handbook", Wiley, 2014.
2. Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, 2015.
3. Tim Boyle, "CCNA Security Study Guide", Wiley, 2014.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

1. Term work shall consist of minimum 7 experiments, 1 Power Point Presentation and minimum 2 assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks

ii. Journal Documentation (Write-up, Power Point Presentation and Assignments: 10 marks

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

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology	Semester : VI
Course : Information Systems & IT Governance	Course Code: DJ19ITEC6016
Course : Information Systems & IT Governance Laboratory	Course Code: DJ19ITEL6016

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: NA

Course Objectives: The objective of this course is to expose the students to the challenges faced by managers related to information systems and IT investments. The course also familiarizes students with the various initiatives taken by government for promoting E-Governance, E-Governance models and IT Act.

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

1. Identify the necessary support an information system can provide to each functional area of the organization.
2. Evaluate the IT investment process.
3. Assess IT investment decisions as per 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	04

	Against Pitfalls	
6.	**E-Governance:** Introduction to E-Governance, Need and Importance of E-Governance, Stages of E-Governance, Digital India Programme, Role of ICT in E-Governance, Categories of E-Governance, Key Issues of E-Governance, Technology, Policies, Infrastructure, Training, Copyrights, Consulting Funds.	**08**

Suggested Lab 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 Digital India Programme
10. Case study on Interactive Service Model (G2C2G)

Books Recommended:

Textbooks:

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", Jain Publications, 1st Edition, 2008.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. An oral examination is to be conducted on the above syllabus.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each is to be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall be evaluated based on: laboratory work, journal and minimum two assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (implementation of experiments as suggested by faculty): 15 marks
ii. Journal Documentation (Write-up and Assignments): 10 marks

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

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<table>
<tr><td colspan="6">Program: Third Year Information Technology</td><td colspan="6">Semester : VI</td></tr>
<tr><td colspan="6">Course : Innovative Product Development-IV</td><td colspan="6">Course Code: DJ19ILL2</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours/week)</td><td colspan="12">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td colspan="4">Continuous Assessment Marks (B)</td><td colspan="4" rowspan="2">Total marks (A+ B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="4">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td></tr>
<tr><td colspan="4">--</td><td>--</td><td>--</td><td>--</td><td colspan="4">--</td></tr>
<tr><td colspan="4">Laboratory Examination</td><td colspan="3">Termwork</td><td rowspan="2">Total Term work</td><td colspan="4" rowspan="2">50</td></tr>
<tr><td>--</td><td>02</td><td>--</td><td>01</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td colspan="2">Tutorial / Mini project / presentation/ Journal</td></tr>
<tr><td colspan="4"></td><td>25</td><td>--</td><td>--</td><td>--</td><td colspan="2">--</td><td>25</td><td colspan="4"></td></tr>
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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 conceptualise and create a successful product.

Course Outcome: On completion of the 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 conceptualising 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 analyse 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 organisations 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.

Prepared by Checked by Head of the Department Principal

Program: Third Year Information Technology	Semester : VI
Course : Environmental Studies	Course Code: DJ19A5

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				-			-	-	-	-
				Laboratory Examination			Term work		Total Term work	-
1	-	-	-	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				-	-	-	-	-	-	

Pre-requisite: Interest in Environment and its impact on Human

Course Objectives:

1. Understand environmental issues such as depleting resources, pollution, ecological problems and the renewable energy scenario.
2. Familiarise environment related legislation

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

1. Understand how human activities affect environment
2. Understand the various technology options that can make a difference

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Social Issues and Environment:** Ecological footprint and Carrying Capacity, Depleting nature of Environmental resources such as soil, water minerals and forests, Carbon emissions and Global Warming.	04
2	**Technological Growth for Sustainable Development:** Social, Economical and Environmental aspects of Sustainable Development, Renewable Energy Harvesting, Concept of Carbon credit, Green Building, Power and functions of Central Pollution Control Board and State Pollution Control Board .	04
3	**Green Technology:** History, Agenda, and Challenges Ahead. Sustainable Cloud Computing, and Risk Management, Sustainable Software Design, Data Center Energy Efficiency, Thin-Client and Energy Efficiency.	05

Books Recommended:

Text books:

1. R. Rajagopalan, "Environmental Studies From Crisis to Cure", 2012.
2. Erach Bharucha, "Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education".
3. Mohammad Dastbaz, Colin Pattinson, Babak Akhgar, Morgan and Kaufman, "Green Information Technology A Sustainable Approach", Elsevier, 2015.

Reference Books:

1. Paulina Golinska, Marek Fortsch, Jorge Marx-Gómez, "Information Technologies in Environmental Engineering: New Trends and Challenges", Springer, 2011.

Prepared by Checked by Head of the Department Principal