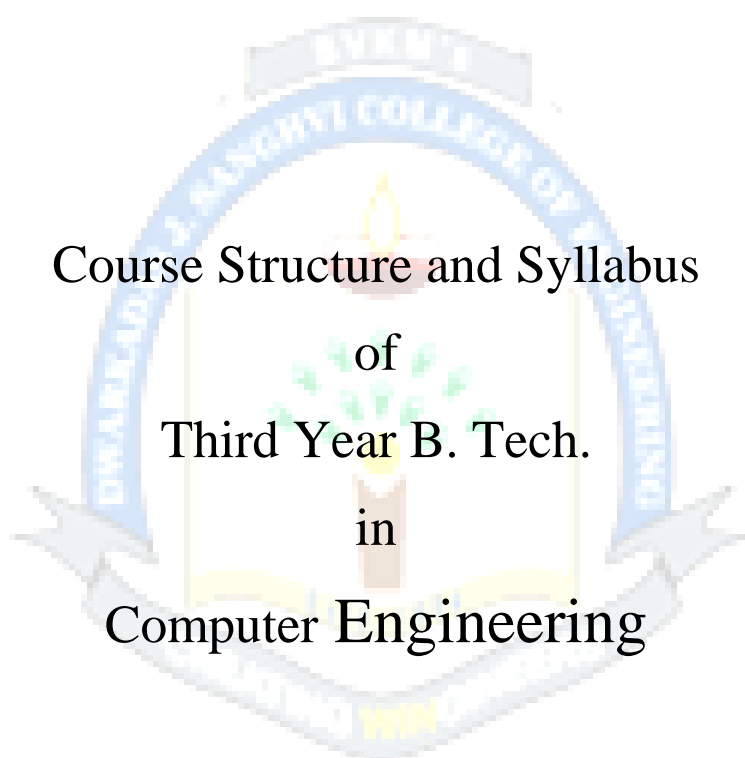Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Course Structure and Syllabus

of

Third Year B. Tech.

in

Computer Engineering

Prepared by:- Board of Studies in Computer Engineering

Recommended by:- Academic Council of D. J. Sanghvi College of Engineering

Approved by:- Governing Body of D. J. Sanghvi College of Engineering

Revision: 1 (2021)

With effect from the Academic Year: 2021-2022

Scheme for Third Year B.Tech. Program in Computer Engineering : 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	End Sem Exam Total	Term Test 1 (TT1)	Term Test 2 (TT2)	Avg (TT1 & TT2)	Termwork	CA Total			
1	DJ19CEC501	Data Mining and Warehouse	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19CEL501	Data Mining and Warehouse Laboratory	--	2	--	1	2	--	--	--	25	25	--	--	--	25	25	50	1	
2	DJ19CEC502	Processor Organization and Architecture	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19CEL502	Processor Organization and Architecture Laboratory	--	2	--	1	2	--	--	--	25	25	--	--	--	25	25	50	1	
3	DJ19CEC503	Artificial Intelligence	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19CEL503	Artificial Intelligence Laboratory	--	2	--	1	2	--	--	--	25	25	--	--	--	25	25	50	1	
4@	DJ19CEEC5011	Advanced Operating System	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19CEEL5011	Advanced Operating System Laboratory	--	2	--	1	2	--	--	--	25	25	--	--	--	25	25	50	1	
	DJ19CEEC5012	Advanced Databse Management System	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19CEEL5012	Advanced Database Mangement System Laboratory	--	2	--	1	2	--	--	--	25	25	--	--	--	25	25	50	1	
	DJ19CEEC5013	Network Engineering	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19CEEL5013	Network Engineering Laboratory	--	2	--	1	2	--	--	--	25	25	--	--	--	25	25	50	1	
5	DJ19CEL504	Programming Laboratory-II (Python)	--	4	--	2	--	--	--	--	25	25	--	--	--	50	50	75	2	2
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	12	18	0	21	20	300	25	0	125	425	100	100	100	225	325	775	21	21

@ Any 1 elective course

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

Prepared by: **HoD**

Name and Signatures (with date)   **Department of Computer Engineering**   **Vice-Principal**   **Principal**

Checked By

Name and Signatures (with date)

Scheme for Third Year B.Tech. Program in Computer Engineering : 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	Theory	Oral	Pract	Oral & Pract	End Sem Exam Total	Term Test 1 (TT1)	Term Test 2 (TT2)	Avg (TT1 & TT2)	Termwork / Term Work Total	CA Total			
1	DJ19CEC601	Software Engineering	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19CEL601	Software Engineering Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
2	DJ19CEC602	Advance Algorithm	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19CEL602	Advance Algorithm Laboratory	--	2	--	1	2	--	--	--	25	25	--	--	--	25	25	50	1	
3	DJ19CEC603	Information Security	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19CEL603	Information Security Laboratory	--	2	--	1	2	--	--	--	25	25	--	--	--	25	25	50	1	
4@	DJ19CEEC6011	Big Data Infrastructure	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19CEEL6011	Big Data Infrastructure Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19CEEC6012	Internet of Things	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19CEEL6012	Internet of Things Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19CEEC6013	Business Analytics	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19CEEL6013	Business Analytics Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
5@	DJ19CEEC6021	Machine Learning	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19CEEL6021	Machine Learning Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19CEEC6022	Compiler Design	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19CEEL6022	Compiler Design Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19CEEC6023	Human Machine Interaction	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19CEEL6023	Human Machine Interaction Laboratory	--	2	--	1	2	--	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	27	375	100	0	50	525	125	125	125	150	275	800	21	21

@ Any 1 Elective Course

Prepared by: **HoD**

Name and Signatures (with date)   **Department of Computer Engineering**   **Vice-Principal**   **Principal**

 Checked By

Name and Signatures (with date)

Program: Third Year B.Tech. in Computer Engineering						Semester : V			
Course : Data Mining and Warehouse						**Course Code:DJ19CEC501**			
Course : Data Mining and Warehouse Laboratory						**Course Code: DJ19CEL501**			
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**	
3	1	-	4	**Oral**	**Practical**	**Oral &Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**	**50**
				-	-	25	15	10	25

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

Course Objectives:

1. To identify the scope and essentiality of Data Mining and Warehouse.
2. To analyze data, choose relevant models and algorithms for respective applications.
3. To develop research interest towards advances in data mining.

Outcomes: On successful completion of course learner will be able to:

1. Understand Data Warehouse fundamentals and data mining principles.
2. Design data warehouse with dimensional modelling
3. Understand ETL process and apply OLAP operations.
4. Apply appropriate pre-processing techniques.
5. Identify appropriate data mining algorithms to solve real world problems.
6. Compare and evaluate different data mining techniques like classification, clustering and association rule mining

Syllabus for Third Year B.Tech Program in Computer Engineering- Semester V (Autonomous)
(Academic Year 2021-2022)

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Data Warehouse and Dimensional modelling:** Introduction to Strategic Information, Need for Strategic Information, Features of Data Warehouse, Data warehouse versus Data Marts, Data warehouse versus Data Lake, Top-down versus Bottom-up approach. Data warehouse architecture, metadata, E-R modelling versus Dimensional Modelling, Information Package Diagram, STAR schema, STAR schema keys, Snowflake Schema, Fact Constellation Schema, Factless Fact tables, Update to the dimension tables, Aggregate fact tables.	8
2	**ETL Process and OLAP:** Major steps in ETL process, Data extraction: Techniques, Data transformation: Basic tasks, Major transformation types, Data Loading: Applying Data, OLTP Vs OLAP, OLAP definition, Dimensional Analysis, Hypercubes, OLAP operations: Drill down, Roll up, Slice, Dice and Rotation, OLAP models: MOLAP, ROLAP.	6
3	**Introduction to Data Mining, Data Exploration and Preprocessing:** Data Mining Task and Techniques, KDD process, Issues in Data Mining, Applications of Data Mining Data Exploration: Types of Attributes, Statistical Description of Data, Data Visualization, Measuring data similarity and dissimilarity. Data Preprocessing: Major tasks in preprocessing, Data Cleaning: Missing values, Noisy data; Data Integration: Entity Identification Problem, Redundancy and Correlation Analysis, Tuple Duplication, Data Value Conflict Detection and Resolution; Data Reduction: Attribute subset selection, Histograms, Clustering and Sampling; Data Transformation & Data Discretization: Data Transformation by Normalization, Discretization by Binning, Discretization by Histogram Analysis, Concept hierarchy generation for Nominal data	6
4	**Classification and Prediction:** Basic Concepts of classification, Decision Tree Induction, Attribute Selection Measures using Information Gain, Tree pruning Bayes Classification Methods: Bayes' Theorem, Naïve Bayesian Classification Rule - Based Classification: Using IFTHEN Rules for classification, Rule Extraction from a Decision Tree, Rule Quality Measures, Rule Pruning Model Evaluation & Selection: Metrics for Evaluating Classifier Performance, Holdout Method and Random Subsampling, Cross Validation, Bootstrap, Model Selection Using Statistical Tests of Significance, Comparing Classifiers Based on Cost–Benefit and ROC Curves Improving Classification Accuracy: Ensemble classification, Bagging, Boosting and AdaBoost, Random Forests, Improving Classification Accuracy in Class Imbalance Data Prediction: Simple Linear regression	6
5	**Clustering:** Cluster Analysis and Requirements of Cluster Analysis Partitioning Methods: k-Means, k-Medoids Hierarchical Methods: Agglomerative, Divisive Density Based Methods: DBScan Evaluation of Clustering: Assessing Clustering Tendency, Determining Number of Clusters and Measuring cluster quality: Intrinsic and Extrinsic methods	5
6	**Mining Frequent Patterns and Association Rules:**	6

	Market Basket Analysis, Frequent Item sets, Closed Item sets, and Association Rule Frequent Item set Mining Methods: Apriori Algorithm, Association Rule Generation, Improving the Efficiency of Apriori. FP growth, Mining frequent Itemsets using Vertical Data Format Introduction to Mining Multilevel Association Rules and Multidimensional Association Rules	
7	**Spatial and Web Mining:** Spatial Data, Spatial Vs. Classical Data Mining, Spatial Data Structures, Mining Spatial Association and Co-location Patterns, Spatial Clustering Techniques: CLARANS Extension, Web Mining: Web Content Mining, Web Structure Mining, Web Usage mining, Applications of Web Mining	5

Books Recommended:

1. *Paulraj Ponniah, ―Data Warehousing: Fundamentals for IT Professionals‖, Wiley India.*
2. *Reema Theraja ―Data warehousing‖, Oxford University Press.*
3. *Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann 3rd   edition.*
4. *M.H. Dunham, "Data Mining Introductory and Advanced Topics", Pearson   Education.*

Suggested List of Experiments:

Sr. No.	Title of Experiments

1.	Build Data Warehouse/Data Mart for a given problem statement
	    i. Identifying the source tables and populating sample data
	    ii. Making information package diagram
	    iii. Design dimensional data model i.e. Star schema, Snowflake schema and Fact Constellation schema (if applicable)

2.	Perform data Pre-processing task on your dataset
3.	To perform various OLAP operations such as slice, dice, drilldown, rollup, pivot

4.	Implementation of Classification algorithm
	    i. Using Decision Tree ID3
	    ii. Naïve Bayes algorithm

5.	Implementation of Clustering algorithm
	    i. K-means
	    ii. Hierarchical clustering (single/complete/average)
	    iii. DBScan

6.	Implementation of Association Rule Mining algorithm 1. Apriori algorithm

	2. FP Tree algorithm	
7.	Demonstrate performing Classification, Clustering, Association algorithm on data sets using data mining tool (WEKA, R tool, XL Miner, etc.)	
8.	Case study on recent data mining applications	

Evaluation Scheme:

Semester End Examination (A):

Theory:

   1. Question paper based on the entire syllabus, summing up to 75 marks.

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

Laboratory:

   1. Oral & Practical 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)

   Laboratory work will be based on **DJ19CEL501** with experiments to be performed in Python / R programming languages.

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 B.Tech. in Computer Engineering								Semester : V		
Course : Processor Organization and Architecture								Course Code: DJ19CEC502		
Course : Processor Organization and Architecture Laboratory								Course Code: DJ19CEL502		
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total Marks= (A+ B)
Lecture	Practical	Tutorial	Total Credit	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	Labora tory Work	Tutorial / Mini project / presentation/ Journal		
				-	-	25	15	10	25	

Pre-requisite: Digital Electronics, Operating systems

Course Objectives:

1. To have a thorough understanding of the basic structure and operations of a computer system.
2. To study the hierarchical memory system including cache memories and virtual memory.
3. To prepare students for higher processor architectures and embedded systems.
4. To apply innovative solutions and make progress in the knowledge to exploit the new paradigms of computing, particularly in distributed environments.

Outcomes: On successful completion of course learner will be able to:

1. Understand the arithmetic and logic algorithms for processors.
2. Understand the concepts of memory organization and mapping techniques.
3. Explain, Interpret and implement the instructions and addressing modes of 8086 microprocessor and write assembly and mixed language programs.
4. Understand the architecture and concepts of an 8051 microcontroller.
5. Understand advanced trends and technologies in processor architectures.

Detailed Syllabus: (unit wise)		
Unit	Description	Duration
1	**Introduction to Computer Architecture & Organization:** Introduction, Basic organization of computer architecture; Von Neumann model and Harvard architecture; Data Representation and Arithmetic Algorithms- Addition, Subtraction, Multiplication - unsigned multiplication, Booth's algorithm (Signed multiplication), Division of integers - restoring division, non-restoring division.	6
2	**Memory organization:** Types of RAM (SRAM, DRAM, SDRAM, DDR, SSD) and ROM; Characteristics of memory; Memory hierarchy- cost and performance measurement; Virtual Memory: Concept, Segmentation and Paging; Address translation mechanism; Interleaved and Associative memory; Cache memory Concepts, Cache Coherency	8
3	**Intel 8086 architecture and addressing modes:** Major features of 8086 processor; 8086 CPU architecture and pipelined operations; programmer's model and 8086 pin description; 8086 addressing modes.	6
4	**8086 Instruction set, Interrupts and Programming:** Instruction set of 8086 microprocessor; assembler directives; procedure and macros; Interrupts in 8086 microprocessor: Dedicated interrupts, Software interrupts, DOS interrupts (Programming examples); Assembly language programming for 8086 microprocessor; mixed mode programming for 8086.	10
5	**8051 microcontroller:** Architecture of 8051 microcontroller; Addressing modes for 8051; Instruction set for 8051 microcontroller: Data transfer, Arithmetic and logical; Interrupts in 8051 microcontroller.	6
6	**Intel Pentium Processor:** Features of Intel Pentium processor, Pentium Superscalar architecture, Pipelining, Branch prediction, Instruction and data cache concept.	6

Books Recommended:

1. *William Stallings- "Computer Organization and Architecture: Designing for Performance", Pearson Publication, 10th Edition, 2013.*
2. *John P. Hayes- "Computer Architecture and Organization", McGraw-Hill, 1988.*
3. *John Uffenbeck – "8086/8088 family: Design Programming and Interfacing", PHI.*
4. *Douglas Hall- "Microprocessor and Interfacing", Tata McGraw Hill.*
5. *M. A. Mazidi, J. C. Mazidi, Rolin D. McKinlay- "The 8051 Microcontroller and Embedded Systems Using Assembly and C", Pearson Education, 2ndEdition.*
6. *Kenneth J. Ayala- "The 8051 Microcontroller", Cengage Learning India Pvt. Ltd, 3rdEdition*
7. *James L. Antonakos- "The Intel Microprocessor family: Hardware and Software principles and Applications", Cengage Learning.*

Suggested List of Experiments:

Sr. No.	Title of Experiments
1.	To implement shift and add method of multiplication algorithm.
2.	To implement Booth's multiplication algorithm.
3.	To study and implement Restoring division algorithm.
4.	To study and implement Non- Restoring Division algorithm.
5.	To implement First Fit Memory allocation policy.
6.	To implement Best Fit Memory allocation policy.
7.	To study and implement FIFO page replacement policy
8.	To study and implement LRU page replacement policy
9.	Assembly program for 16-bit addition
10.	Assembly Program to transfer n block of data from one segment to another segment.
11.	Assembly program to sort numbers in ascending/ descending order
12.	Assembly program to find minimum/ maximum no. from a given array.
13.	Assembly language program using Macros.
14.	To implement mixed language programming using Assembly Language and C.

Evaluation Scheme:

Semester End Examination (A):

Theory:

      1. Question paper based on the entire syllabus, summing up to 75 marks.

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

Laboratory:

1. Oral & Practical 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)

Laboratory work will be based on **DJ19CEL502** with minimum 10 experiments to be incorporated.

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 B.Tech. in Computer Engineering								Semester : V	
Course : Artificial Intelligence								**Course Code: DJ19CEC503**	
Course : Artificial Intelligence Laboratory								**Course Code: DJ19CEL503**	
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**
3	**2**	**-**	**4**	**Oral**	**Practical**	**Oral** **&Practical**	**Laboratory Work**	**Tutorial /** **Mini project** **/** **presentation/** **Journal**	
				-	**-**	**25**	**15**	**10**	**25**	**50**

Pre-requisite: Knowledge of
      1. Basic Mathematics
      2. Algorithms

Objectives:
1. Provide the basic ideas and techniques underlying the design of intelligent systems.
2. Impart the knowledge of various search techniques for problem solving.
3. Learn knowledge representation and provide the knowledge to deal with uncertain and incomplete information.
4. Impart the knowledge of planning and forms of learning.
5. Learn to apply techniques of Artificial Intelligence to different applications

Outcomes: On completion of the course, learner will be able
1. Develop a basic understanding of AI building blocks presented in intelligent agents.
2. Design appropriate problem solving method for an agent to find a sequence of actions to reach goal state.
3. Analyse various AI approaches to knowledge– intensive problem solving, reasoning and planning.
4. Design models for reasoning with uncertainty as well as different types of learning.
5. Design and develop the AI applications in real world scenario.

	Detailed Syllabus: (unit wise)	
Unit	**Description**	**Duration**
1	**Introduction to Artificial Intelligence :** Introduction, History of Artificial Intelligence, Intelligent Systems: Categorization of Intelligent System, Components of AI Program, Foundations of AI, Sub-areas of AI, Current trends in AI **Intelligent Agents :** Agents and Environments, The concept of rationality, The nature of environment, The structure of Agents, Types of Agents, Learning Agent.	05
2	**Problem solving :** Solving problem by Searching: Problem Solving Agent, Formulating Problems, Example Problems. **Search Methods:** Uninformed search, Breadth First Search (BFS), Depth First Search (DFS), Depth Limited Search, Depth First Iterative Deepening (DFID), Informed Search Methods: Greedy best first Search, A* Search, Memory bounded heuristic Search. **Local Search Algorithms and Optimization Problems:** Hill climbing search, Simulated annealing, Local beam search, Genetic algorithms, Ant Colony Optimization **Adversarial Search:** Games, Optimal strategies, The minimax algorithm, Alpha-Beta Pruning.	12
3	**Knowledge and Reasoning :** Knowledge based Agents, The Wumpus World, Propositional Logic, First Order Logic, Inference in FOL, Forward chaining, Backward chaining, Knowledge Engineering in First-Order Logic, Unification, Resolution, logic programming (PROLOG), Knowledge Representation: Ontological Engineering, Semantic networks, Description logics, RDF, OWL, Semantic Web. **Uncertain Knowledge and Reasoning:** Uncertainty, Representing knowledge in an uncertain domain, The semantics of Bayesian belief network, Inference in belief network. Rule-based methods for uncertain reasoning, Dempster-Shafer theory, Fuzzy sets and fuzzy logic.	10
4	**Planning** : The planning problem, Planning with state space search, Planning graphs, Partial order planning, Hierarchical planning, Planning and Acting in Nondeterministic Domain : Sensorless planning, Contingent planning, Online replanning, Multiagent planning.	05

5	**Learning**: Types of Learning, Inductive Learning **Artificial Neural Networks:** McCulloh Pitts Model, Perceptron, Feed Forward Network, Backpropagation Algorithm, Self Organizing Map.	06
6	**Expert System:** Introduction, Phases in building Expert Systems, ES Architecture **Applications :** Natural Language Processing, Robotics, Character Recognition, Genetic Algorithm in game playing, Travelling Salesman Problem, Best path finding, Recommender Systems, Prediction Systems, Atari Games, Face Recognition	04

List of Laboratory Experiments:

Sr. No.	Title of Experiments

1.	Select a problem statement relevant to AI.
	    i) Identify the problem
	    ii) PEAS Description
	    iii) Problem formulation

2.	Program to implement Family Tree in Prolog
3.	Identify and analyze uninformed search Algorithm to solve the problem. Implement BFS/DFS/DFID search algorithms to reach goal state.
4.	Identify and analyze informed search Algorithm to solve the problem. Implement A* search algorithm to reach goal state.
5.	Program to implement Local Search algorithm : Hill climbing search
6.	Program on Genetic Algorithm to solve a optimization problem in AI.
7.	Identify,analyze, implement a planning problem/Rule based Expert System in a real world scenario.
8.	Implementation on any AI Problem : Wumpus world, Tic-tac-toe, 8-Queens Problem
9.	Program to implement learning : Perceptron Learning/Backpropagation Algorithm.
10.	Case study of an AI Application.

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

Books Recommended:

Text Books
1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach "Second Edition" Pearson Education.
2. Saroj Kaushik "Artificial Intelligence", Cengage Learning.
3. George F Luger "Artificial Intelligence" Low Price Edition, Pearson Education., Fourth edition.
4. Deepak Khemani." A First Course in Artificial Intelligence", McGraw Hill Education (India), 2013.

Reference Books

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

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 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)

Laboratory work will be based on **DJ19CEL503** with minimum 10 experiments.

The distribution of marks for term work shall be as follows:
1. Laboratory work (Performance of Experiments): 15 Marks
2. 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 B.Tech. in Computer Engineering							Semester : V		
Course : Advanced Operating System							Course Code: DJ19CEEC5011		
Course : Advanced Operating System Laboratory							Course Code: DJ19CEEL5011		
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
3	2	--	4	Oral	Practical	Oral &Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	50
				-	-	25	15	10	25

Pre-requisite: Operating System and Computer Organization.

Course Objectives:

1. To understand the difference between distributed, multiprocessor and virtualization concepts.
2. To explore Real time operating system concepts.
3. To explore mobile operating system.

Outcomes: On successful completion of course learner will be able to:

1. Analyze the difference between different types of operating systems.
2. Describe real time operating systems.
3. Apply correct distributed and multiprocessor operating system concepts to solve real life problems.
4. Improve system performance by applying virtualization concepts.
5. Understand mobile operating system.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction** Functions of operating systems, design approaches: layered, kernel based and virtual machine approach, need for advanced operating systems, types of advanced operating systems (NOS, DOS, Multiprocessor OS, Mobile OS, RTOS, Cloud OS)	4
2	**Distributed operating Systems:** Architecture of distributed operating systems, system architecture types, issues in distributed operating systems, inherent limitation of distribute systems. Distributed mutual exclusion: classification of mutual exclusion algorithms, Lamport's, token-based algorithm, Suzuki-Kasami's Broadcast algorithm, Raymond's Tree based algorithm Distributed deadlock detection, Distributed file systems, Distributed shared memory, Distributed scheduling	10
3	**Real Time Operating Systems:** Basic Model of Real time systems, Characteristics, Applications of Real time systems, Real time task scheduling, Types of tasks and their characteristics. Task Scheduling, Clock driven Scheduling, Hybrid Schedulers, Event driven Scheduling, EDF Scheduling, Rate Monotonic Algorithm, handling resource sharing Resource Handling: Resource Sharing, Priority Inversion, PIP, PCP, HLP, Scheduling real time tasks in distributed systems	10
4	**Multiprocessor Operating Systems:** Introduction, Basic multiprocessor system architectures, design issues, Threads Process synchronization: the test and set instruction, the swap instruction, implementation of the process wait. Processor scheduling: Issues, Co-scheduling, Smart scheduling, Affinity Based scheduling	6
5	**Virtualisation:** Introduction to Virtualisation, Types of Virtualisation, Bare Metal (XEN), Hosted (KVM) Virtualisation, Para virtualisation, Full virtualisation, Emulation, Server Virtualisation, Network Virtualisation and Storage Virtualisation.	6
6	**Mobile Operating System:** Symbian O.S: introduction, kernel design in Symbian OS, scheduling in Symbian OS, File systems on mobile phones, I/O in Symbian OS, Application development using Android.	6

Books Recommended:

1. Mukesh Singhal, Niranjan Shivaratri—Advance Concepts in Operating System, Mc Graw Hill.
2. K. C. Wang – embedded and Real Time Operating System, Springer.
3. Cris Wolf and Eric M Halter – Virtualization from Desktop to Enterprise, Apress.
4. Ben Morris – The Symbian OS Architecture Source Book, Willey India.
5. Sunita Mahajan and Seema Shah, Distributed System, Oxford.

Suggested List of Experiments:

LAB	Topic / Activity	Explanation of Activity
Lab1	Distributed Programming	Implement concurrent client-server application.
Lab2	Logical Clock	Simulate Lamport's logical clock
Lab3	Distributed Mutual Exclusion	Implement Ricart-Aggarwala Algorithm.
Lab4	Distributed Deadlock	Demonstrate deadlock detection using Edge Chasing algorithm.
Lab5	Hosted Virtualization	Demonstrate hosted virtualization using KVM.
Lab6	Bare Metal Virtualization	Load a new operating system virtually on the client machine using the concept of bare metal virtualization by XEN.
Lab7	Android Programming Basics	Hello world, linking activities, passing data.
Lab8	Handing image and text using Android Programming	ICreate a simple list view with image and text.
Lab9	Building an Application using Android	Integrate a website inside an application, use of SQLite.
Lab10	Case study	Symbian OS

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus, 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 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)

Laboratory work will be based on **DJ19CEEL5011** with minimum 10 experiments to be incorporated.

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 B.Tech. in Computer Engineering						Semester : V			
Course : Advanced Database Management System						Course Code: DJ19CEEC5012			
Course : Advanced Database Management System Laboratory						Course Code: DJ19CEEL5012			
Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)		Continuous Assessment Marks (B)			Total marks (A+ B)
				Theory		Term Test 1	Term Test 2	Avg.	
Lectures	Practical	Tutorial	Total Credits	75		25	25	25	100
				Laboratory Examination			Term work		Total Term work
3	2	-	4	Oral	Practical	Oral &Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	50
				-	-	25	15	10	25

Prerequisite: Basic knowledge of Database management System.

Objectives:

1. To provide overview of advancement in SQL and Database technology.
2. To impart knowledge of query processing and optimization.
3. To provide an overview of distributed database systems.
4. To introduce the concept of document-oriented database.
5. To create awareness about potential security threats to a database and mechanisms to handle it.
6. Understand the usage of advanced data models for real life application.

Outcomes: On completion of the course, learner will be able:

1. Discuss new developments in database technology.
2. Measure query cost and optimize query execution.
3. Design distributed database for better resource management.
4. Demonstrate the understanding of the concepts of document-oriented databases.
5. Apply appropriate security techniques database systems.
6. Implement advanced data models for real life applications.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Advance Databases**	**06**
	Indexing and Hashing:Types of Single-Level Ordered Indexes; Multilevel Indexes; Dynamic Multilevel Indexes Using B-Trees and B+-Trees;	
	New database applications and architectures: e.g., Data Warehousing; Multimedia database; Mobility database; NoSQL, Native XML databases (NXD), Document orientated databases, Graph database, Federated Databases	
2	**Query processing and Optimization**	**08**
	Query Processing: Overview, Measures of Query cost, Selection operation, Sorting, Join Operations, and other Operations, Evaluation of Expression	
	Query Optimization: Translations of SQL Queries into relational algebra, Heuristic approach and cost-based optimization	
3	**Distributed Databases**	**08**
	Introduction: Types of Distributed Database Systems, Distributed Database Architectures	
	Distributed Database Design: Data Fragmentation, Replication and Allocation Techniques	
	Distributed Query Processing (Semi join)	
	Transaction Management, Concurrency Control (locking) and Recovery in Distributed Databases	
4	**Document oriented database**	**08**
	Object Oriented Database: Need of object-oriented database, Impedance matching problem between OO languages and Relational database, Case study db4O	
	Document Oriented Database: Need of Document Oriented database, difference between Document Oriented Database and Traditional database, Types of encoding XML, JSON, BSON, Representation XML, Json Objects. Case study on doc oriented based such a Mariadb	
5	**Advanced data models**	**06**
	Temporal data models: Aspects of valid time, Bitemporal time and bi-temporal time with examples of each.	
	Spatial model: Types of spatial data models - Raster, Vector and Image	
	MYSQL Postgres, Mobile databases	
6	**Data Security**	**06**
	Introduction to Database Security Issues; Authentication and authorization, Database auditing, Discretionary Access Control Based on Granting and Revoking Privileges, Mandatory Access Control and Role-Based	
	Access Control for Multilevel Security	
	Introduction to Statistical Database Security	

Books Recommended:

Text books:

1. Elmasri&Navathe, "Fundamentals of Database Systems" IV edition. PEARSON Education.
2. Korth, Silberschatzsudarshan, "Database systems, concepts" 5th edition McGraw Hill
3. Raghu Ramkrishnan& Johannes Gehrke, "Database Management System" Tata McGraw Hill. III edition.
4. Ruosell J.T. Dyer, Learning MySQL and Mariadb.

Reference Books:

1. Chhanda Ray, "Distributed Database System", Pearson Education India.
2. Hector Garcia-Molina, Jeffery D. Ullman, Jennifer Widom, "Database system Implementation"
3. Thomas M.Connolly Carolyn Begg, Database Systems: A practical Approach to Design, Implementation and Management, 4/e.

Suggested List of Experiments:

LAB	Topic / Activity	Explanation of Activity
Lab1	SQL Programming	Case study on Professional and Commercial Databases: Summary and Comparison
Lab2	Query Optimization	Simulate Query optimization by applying an SQL Query on any database.
Lab3	Query Monitoring	Implementation of Query monitor (QEP- Query Execution Plan, Query Statistics)
Lab4	Distributed Database Design	Perform Fragmentation (Range, List, Hash and Key) in DDBS design.
Lab5	Distributed Database Design	Implementation of Replication transparency in DDB
Lab6	Distributed Database Design	Implementations of two phase / three phases commit protocol.
Lab7	XML Programming	Query execution on XML database.
Lab8	Document Database	Data handing using JSON. (eg. Display user information from JSON file downloaded from Mobile)
Lab9	Spatial and Temporal Data Handling	Processing of Spatial and temporal data
Lab10	Case study	Case study on Database security issues and measures taken to handle those issues.

Evaluation Scheme:

Semester End Examination (A):

Theory:

      1. Question paper based on the entire syllabus, summing up to 75 marks.

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

Laboratory:

    1. Oral & Practical 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 the two tests will be considered for final grading.

Laboratory: (Term work)

  Laboratory work will be based on **DJ19CEEL5012** with minimum 10 experiments to be incorporated.

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 B.Tech. in Computer Engineering						Semester : V				
Course : Network Engineering						**Course Code: DJ19CEEC5013**				
Course : Network Engineering Laboratory						**Course Code: DJ19CEEL5013**				
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**	
3	2	-	4	**Oral**	**Practical**	**Oral &Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation / Journal**		50
				-	-	25	15	10	25	

Pre-requisite: Computer Networking.

Objectives: Students will try to:

1. Study the Design and Analysis of Advance Computer network.
2. Acquire knowledge of design and analysis of networking paradigms and protocols.
3. Gain advance knowledge of Network layer routing protocols and IP addressing.
4. Study complex network concepts and design issues.
5. Study advance networking architectures vise Software defined network (SDN).
6. Understand the high-performance networking and apply them in real time applications.

Outcomes: Students will be able to

1. Analyze the existing network architecture.
2. Understand the routing design principles.
3. Describe different protocol specifications and their components.
4. Design the complex network by converging different technologies.
5. Understand and explain advance network architectures and its components.
6. Understanding and developing high performance networks.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Design and Analysis of networks** Address Masks, Prefixes, and Sub networks, Network Address Translation (NAT) IP Switching and Routing - Local Delivery and Loopbacks - Address Resolution Protocol Route Control and Recording Fast Retransmit and Fast Recovery - Congestion-Avoidance Mechanisms – DECbit - Random Early Detection - Source-Based Congestion Avoidance – Tahoe, Reno, and Vegas QoS Application Requirements - Real-Time Audio - Taxonomy of Real-Time Applications - Approaches to QoS Support	06
2	**Internet Routing Design** Router Architectures: Functions, Types, Elements of a Router, Packet Flow Packet Processing: Fast Path versus Slow Path Router Architectures QoS Attributes Adapting Routing: A Basic Framework. Update Frequency, Information Inaccuracy, and Impact on Routing Dynamic Call Routing in the PSTN Heterogeneous Service, Single-Link Case A General Framework for Source-Based QoS Routing with Path Caching, Routing Protocols for QoS Routing	08
3	**Protocol Engineering** Protocol Specification: Components of specification, Service specification. Communication Service Specification Protocol entity specification: Sender, Receiver and Channel specification Interface specifications Interactions, Multimedia specifications, Alternating Bit Protocol Specification, RSVP specification Protocol Specification Language (SDL): Salient Features. Communication System Description using SDL Structure of SDL. Data types and communication paths Examples of SDL based Protocol Specifications: Question and answer protocol, X-on-X-off protocol, Alternating bit protocol, Sliding window protocol specification	08
4	**Complex Networks** Types of network: Social networks, Information networks, Technological networks, Biological networks Properties of network: Small world effect, transitivity and clustering, degree distribution, scale free networks, maximum degree,network resilience	08

	Applications: Search on networks, exhaustive network search guided network search, network navigation; network visualization	
	5G Mobile network: Requirement, Designing and deployment of 5G networks	
5	**Software Defined Networking**	04
	SDN vs. P2P/Overlay Networks Players in the SDN Eco-system	
	SDN Applications, SDN Open source, SDN Future	
6	**High Performance Networks**	08
	Network Performance analysis: Objectives and requirements for Quality of Service (QoS) in high performance networks Architecture of high performance networks (HPN)	
	Design issues, protocols for HPN, VHF backbone networks	
	Virtual interface architectures, virtual interface for networking	

Books Recommended:

1. Design and Analysis of Communication Networks By V Ahuja , McGraw Hill
2. Storage Networks Explained – UifTroppens, R Erkens and W Muller, John Wiley & Sons, 2003.
3. Alex Goldman, "Storage Area Networks Fundamentals", Cisco Press 2002
4. Storage Area Network Essentials: a Complete Guide to understanding andimplementing SANs- Richard Barker and Paul Massiglia, John Wiley India
5. Paul Goransson, Chuck Black, " Software Defined Networks: A Comprehensive Approach", Morgan Kaufmann, Elsevier, USA, 2014
6. PallapaVenkataram and Sunilkumar S. Manvi: Communication Protocol Engineering, PHI, 2004.
7. S. N. Dorogovtsev and J. F. F. Mendes, Evolution of Networks, Oxford University press
8. James D.McCabe, Network analysis, Architecture and Design, 2nd Edition, Elsevier,2003.
9. Bertsekas&Gallager, Data Networks, second edition, Pearson Education, 2003.

10. 5G Mobile core Network: Design, Deployment, Automation and Testing strategies, by R. Shetty, Apress publication.

Suggested List of Experiments:

Sr. No.	Title of the Experiment
1.	Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default
2.	Configure, implement and debug the following: Use open-source tools for debugging and diagnostics.

3.	Demonstrate any one of the protocol –
	     a) ARP/RARP protocols
	     b) RIP routing protocols
	     c) BGP routing
	     d) OSPF routing protocols

4.	Evaluate Network Performance Evaluation using NS-2
5.	Comparative analysis of routing protocols with respect to QOS parameters using Xgraph /gnuplot for different load conditions.

6.	Analyze HTTP Traffic using Wireshark.	
7.	Configure and use iptables	
8.	Simulate simple SDN network	
9.	Evaluate different QoS parameters through ns2	
10.	Creating and set up a virtual LAN.	

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus, summing up to 75 marks.

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

Laboratory:

1. Practical and 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 the two tests will be considered for final grading.

Laboratory: (Term work)

Laboratory work will be based on **DJ19CEEC5013** with minimum 06 experiments along with a mini project to be incorporated.

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

1. Laboratory work (Performance of Experiments): 15 Marks
2. 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 B.Tech. in Computer Engineering							Semester: V			
Course: Programming Laboratory –II (Python)							**Course Code: DJ19CEL504**			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
				Theory			Term Test 1	Term Test 2	Avg.	
Lectures	Practical	Tutorial	Total Credits							
				-			-	-	-	-
				Laboratory Examination			Term work		Total Term work	
-	4	-	2	Oral	Practical	Oral &Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		75
				-	-	25	25	25	50	

Course Objectives:

1. To learn the basic and OOP concepts of Python.
2. To study various advance python concept like inheritance, exception handling, modules etc.
3. Learn to develop GUI based standalone and web application.

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

1. Understand basic and object-oriented concepts, data structure implementation in python.
2. Apply file, directory handling and text processing concepts in python.
3. Apply database connectivity, client-server communication using python.
4. Apply various advance modules of Python for data analysis.
5. Develop python-based application (web/Desktop) using django web framework/Tkinter.

Unit	Description	Hours
1	**Python basics** Data types in python, Operators in python, Input and Output, Control statement, Arrays in python, String and Character in python, Functions, List and Tuples, Dictionaries Exception, Introduction to OOP, Classes, Objects, Linked List, Stack, Queues, Inheritance	12
2	**Advanced Python** Building Modules, Packages: Python Collections Module, Opening and Reading Files and Folders (Python OS Module, Python Datetime Module, Python Math and Random Modules Text Processing Regular expression in python	10
3	**Python Integration Primer** Graphical User interface using Tkinter : Form designing Networking in Python: Client Server socket programming Python database connectivity: Data Definition Language (DDL), and Data Manipulation Language (DML) Emails with Python: Introduction to Emails with Python, Sending Emails with Python, Receiving Emails with Python	10
4	**Python advance Modules** Numpy: Working with Numpy, Constructing Numpy arrays, Printing arrays, Arithmetic Operations on matrix OpenCV: Open CV - Installation, Sample code – Open CV Matplotlib: Matplotlib-Installation & Sample code, Bar Chart Pandas: Data Processing, Pandas-Data structure, Pandas-Series data, Data Frames	12
5	**Django Framework** Introduction to Django: Django's take on MVC: Model, View and Template, Installation and set up models.py, urls.py, views.py, Setting up database connections Managing Users & the Django admin tool Designing a good URL scheme, Generic Views, Form classes, Validation, Authentication, Advanced Forms processing techniques	12

	Django REST framework	

Books Recommended:

Text books:

1. Core Python Programming, Dr. R. Nageswara Rao, Dreamtech Press

2. Beginning Python: Using Python 2.6 and Python 3.1. James Payne, Wrox publication

3. Introduction to computing and problem-solving using python, E Balagurusamy, McGraw Hill Education.

Reference Books:

1. Learn Python the Hard Way: (3rd Edition) (Zed Shaw's Hard Way Series)

2. Python Projects, Laura Cassell, Alan Gauld, Wrox publication

Digital Material:

1. "The Python Tutorial", http://docs.python.org/release/3.0.1/tutorial/

2. http://spoken-tutorial.org

3. www.staredusolutions.org

4. https://www.tutorialspoint.com/python/index.htm

Suggested experiments using Python:

Expt No	Experiment Title
1	Exploring basics of python like data types (strings, list, array, dictionaries, set, tuples) and control statements.
2	Creating functions, classes and objects using python.
3	Menu driven program for data structure using built in function for link list, stack and queues.
4	Demonstrate exception handling.
5	Python program to explore different types of Modules

6	Demonstrate File handling and Directories
	    a. Python program to append data to existing file and then display the entire file.
	    b. Python program to count number of lines, words and characters in a file.
	    c. Python program to display file available in current directory

7	Make use of RE module to perform text processing.
8	Creating GUI with python containing widgets such as labels, textbox, radio, checkboxes and custom dialog boxes.
9	Program to demonstrate CRUD (create, read, update and delete) operations on database (SQLite/ MySQL) using python.
10	Implementation of simple socket programming for message exchange between server and client.

11	Make use of advance modules of Python like OpenCV, Matplotlib, NumPy
12	Creating web application using Django web framework to demonstrate functionality of user login and registration (also validating user detail using regular expression).

Evaluation Scheme:

Practical and Oral(A):

Oral & Practical examination will be based on the practical's performed during laboratory sessions.

1. Implementation:15 Marks
2. Oral:10 Marks

Total :25 Marks

Continuous Assessment (B):

Term Work:

Laboratory work will be based on syllabus with minimum 10 experiments to be incorporated. Experiments should be completed by students in the given time duration.

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.

1. Laboratory work (Performance of Experiments): 10 Marks
2. MCQ Quiz:15 Marks
3. Mini Project:20 Marks
4. Attendance (Practical): 05 Marks

Total: 50 Marks

Prepared by   Checked by   Head of the Department   Principal

Program: Third Year B.Tech. in Computer Engineering								Semester : V		
Course : Professional and Business Communication Laboratory								Course Code: DJ19IHL2		
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
				Theory			Term Test 1	Term Test 2	Avg.	
Lectures	Practical	Tutorial	Total Credits	--			--	--	--	--
				Laboratory Examination			Term work		Total Term work	
--	4*	--	2	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	50	50
				--	--	--	--	---	50	

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

Pre-requisite:

Basic course in Effective Communication Skills

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

Outcomes: On completion of the course, learner will 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 **Plagiarism :** Types of plagiarism, consequences of plagiarism	**08**
	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",* Thomson Learning, 12th edition

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" Wiley India Edition, 3rd 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:

Assignments ……………………………………………… (25) Marks

Project Report and Presentation…………………………… (15) Marks

Group Discussion……………………………………….. (10) Marks

TOTAL: …………………………………………….... (50) 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 B.Tech. in Computer Engineering							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**
--	02	--	01	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation / Journal	50
				25	--	--	--	--	25

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.

Outcome:

Learner will 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 form a team of 3 to 4 students (max allowed: 5-6 in extraordinary cases, subject to the approval of the department review committee and the Head of the department).
- Students should carry out a survey and identify the need, which shall be converted into conceptualization of a product, in consultation with the faculty supervisor/head of department/internal committee of faculty members.
- Students in the team shall understand the effective need for product development and accordingly select the best possible design in consultation with the faculty supervisor.
- Students shall convert the best design solution into a working model, using various components drawn from their domain as well as related interdisciplinary areas.
- 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 design solution 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 a 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.
- 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 tothe team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.
- Distribution of term work marks during the subsequent semester shall be as given below:
  - Marks awarded by the supervisor based on log-book   : 10
  - Marks awarded by review committee   : 10
  - Quality of the write-up   : 05

In the last review of the semester VI, the term work marks will be awarded as follows.

- Marks awarded by the supervisor (Considering technical paper writing)   : 15
- Marks awarded by the review committee   : 10

Review/progress monitoring committee may consider the following points during the assessment.

- In the semester V, the entire design proposal shall be ready, including components/system selection as well as the cost analysis. Two reviews will be conducted based on the presentation given by the student's team.
  - First shall be for finalisation of the product selected.

- ▪ Second shall be on finalisation of the proposed design of the product.
- In the semester VI, the expected work shall be procurement of components/systems, building of the working prototype, testing and validation of the results based on work completed in semester III.
  - ▪ First review is based on readiness of building the working prototype.
  - ▪ Second review shall be based on a presentation as well as the demonstration of the working model, during the last month of semester IV. This review will also look at the readiness of the proposed technical paper presentation of the team.

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 IV.Students are compulsorily required to present the outline of the technical paper prepared by them during the final review in semester VI.

Prepared by   Checked by   Head of the Department   Principal

Program: Third Year B.Tech. in Computer Engineering										Semester: VI	
Course: Software Engineering										Course Code: DJ19CEC601	
Course: Software Engineering Laboratory										Course Code: DJ19CEL601	

Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)	
Lectures	Practical	Tuto rial	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 / present ation/ Journal	Total Term work	50	
				25	--	--	15	10	25		

Prerequisite:

1. Concepts of Object Oriented Programming & Methodology
2. Knowledge of developing applications with front end & back end connectivity.

Objectives: To provide the knowledge of Standard Software Engineering discipline.

Outcomes: On completion of the course, learner will be able:

1. Understand and Demonstrate basic knowledge in Software Engineering.
2. Identify requirements, analyse, design and develop the software projects.
3. Plan, schedule and track the progress of the projects.
4. Identify risks, manage the configuration and change in software.
5. Apply testing principles on software projects.
6. Apply latest tools and techniques on software projects.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Hours**
1	**Introduction to Software Engineering and Process Models:** Nature of Software, Software Engineering, Software Process, CMM, Generic Process Model. **Prescriptive Process Models:** The Waterfall Model, V Model. **Incremental Process Model:** Incremental Model **Evolutionary Process Models:** Prototyping Paradigm, The Spiral Model **Concurrent Process Models:** Concurrent Process Model **The Unified Process** **Agile Methodology:** Agility Principals, Agile Process Models: Extreme Programming (XP), Adaptive Software Development (ASD), Dynamic Systems Development Method (DSDM), Scrum, Crystal, Feature Driven Development (FDD), Agile Modeling (AM), Kanban Model.	10
2	**Requirement Analysis and Project Estimation:** Requirement Elicitation, Software Requirement Specification (SRS). **Requirement Models:** Scenario Based Models, Class Based Models, Behavioural Models and Flow Models. **Software Project Estimation:** LOC, FP, Empirical Estimation Models COCOMO I COCOMO II, Specialized Estimation Techniques.	08
3	**Design Engineering and Analysis:** Design Principles, Design Concepts, Effective Modular Design-Cohesion and Coupling. **Translating the requirement models into the design model.** **Designs** Architectural Design, Component Level Design, User Interface Design.	06
4	**Project Scheduling and Control:** Management Spectrum, 3Ps, Process and Project Metrics **Scheduling** Work Breakdown Structure, Network Diagram, Gantt Chart.	04
5	**Software Risk:** Risk Identification, Risk Assessment, Risk Projection, Risk Refinement, RMMM Plan. **Software Configuration Management:** SCM, SCM Repositories, SCM Process, Change Control and Version Control.	05
6	**Software Testing Fundamentals:** Strategic Approach to Software Testing, Unit Testing, Integration Testing, Verification, Validation Testing, System Testing, Test Strategies for WebApps **Software Testing Techniques:** White Box Testing, Basis Path Testing, Control Structure Testing and Black Box Testing. TDD	06
7	**Latest Trends In Software Development Engineering:** **DevOps:** DevOps Toolchain, DevOps Architecture (e.g. Docker), DevOps for Deployment.	03

Books Recommended:

Text books:

1. Roger Pressman, "Software Engineering: A Practitioner's Approach", McGraw-Hill Publications 7th Edition.
2. Ian Sommerville, "Software Engineering", Pearson Education 9th Edition.
3. Ali Behfrooz and Fredeick J. Hudson, "Software Engineering Fundamentals", Oxford University Press.

Reference Books:

1. Ugrasen Suman, "Software Engineering-Concepts and Practices", Cengage Learning
2. Pankaj Jalote, "An integrated approach to Software Engineering", Springer/Narosa
3. Jibitesh Mishra and Ashok Mohanty, "Software Engineering", Pearson
4. Rajib Mall, "Fundamentals of Software Engineering", Prentice Hall India.
5. "Machine Learning Applications in Software Engineering" Volume 16, World Scientific by Du Zhang and P Tsai

Suggested List of Experiments:

Lab Session	Title
1	Prepare detailed statement of problem for the selected / allotted mini project and identify suitable process model for the same with justification.
2	Develop Software Requirement Specification (SRS) document in IEEE format for the project.
3	Use project management tool to prepare schedule for the project.
4	Prepare RMMM plan for the project.
5	Identify scenarios & develop UML Use case and Class Diagram for the project.
6	Draw DFD (upto 2 levels) and prepare Data Dictionary for the project.
7	Develop Activity / State Transition diagram for the project.
8	Develop Sequence and Collaboration diagram for the project.
9	Change specification and make different versions using any SCM Tool.
10	Develop test cases for the project using testing techniques.
11	Experiment on DevOps application.

Any other practical covering the syllabus topics and subtopics can be conducted.

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 of course **DJ19CEC601** including the practical performed during laboratory sessions of course **DJ19CEL601**.
2. Oral examination will be of **25 marks**.

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.
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)

Laboratory work will be based on **DJ19CEL601** with minimum 10 experiments.

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

1. Laboratory work (Performance of Experiments): 15 Marks
2. Journal Documentation (Write-up and 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.

Note: Mini Project Presentations can be conducted if required.

Prepared by   Checked by   Head of the Department   Principal

Program: Third Year Computer Engineering	Semester : VI
Course : Advance Algorithm	Course Code: DJ19CEC602
Course: Advance Algorithm Laboratory	Course Code: DJ19CEL602

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	
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	Total Term work	50
				--	--	25	15	10	25	

Prerequisite: Concepts of Data structures, Discrete Mathematics and Analysis of Algorithm

Objectives: To provide conceptual and practical knowledge of Advance Algorithm

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

1. Analyze the chosen algorithm.
2. Choose appropriate data structure and algorithm for given problem statement.
3. Design the algorithm.

Detailed Syllabus: (unit wise)		
Unit	Description	Hours
1	**Analysis of Algorithm Based on Time:** **Asymptotic notations:** Omega, Theta, Big-O, Small-o, small Omega and Tilde **Amortized Analysis:** Aggregate Method, Accounting Method, Potential Method Beyond worst-case analysis Dynamic tables and its amortized analysis RAM model analysis of algorithm	6
2	**Probabilistic and Randomized Algorithm:** Probabilistic approach to algorithm and Randomized Analysis Indicator Random Variable (IRV) Randomized Quick Sort Analysis of Hiring Problem (Flipped Classroom: Analysis of Birthday Paradox Problem, Bins and Balls Problem using IRV) Numerical Probabilistic algorithms with example Las Vegas and Monte Carlo algorithm Game theoretic randomized algorithm techniques (Tic-Tac-Toe)	6
3	**Advanced Data Structures:** **Balanced Search Trees:** Red-Black Tree, Randomized BST, Tango Tree **Heap and Operations:** Binomial Tree, Binomial Heap **Spatial Data Structure:** KD Tree, R Tree (Flipped Classroom: R* Tree) **Probabilistic Data Structure:** LogLog and HyperLogLog, MinHash with Data mining context. (Flipped Classroom: Count-Min Sketch with Data mining context)	12
4	**Graph Based Algorithms:** **Flow Network Introduction:** Residual Network, Augmenting Path, Ford-Fulkerson Method, Edmonds-Karp Method, Push-Relable Algorithm (Flipped Classroom: Relable to Front algorithm) **Bipartite Matching:** Maximum Bipartite Matching, Weighted Bipartite Matching, Weighted Non-Bipartite Matching (Edmonds algorithm) **Max Flow Min Cut**	6
5	**Computational Geometry:** Line Segment Properties, Convex Hull Graham's scan algorithm, Determining whether any pair of segments intersects, Finding the closest pair of points. (Flipped Classroom: Conic Programming) **Geometric Searching:** Point Location in polygon using Ray Crossing. **Online Algorithms:** River Search Problem, Competitive Ratio, K-Server (Flipped Classroom: List accessing, Paging)	6

6	**Algorithm Classes:** P, NP, NP Hardness and NP Completeness	**6**
	Np Completeness Proofs: Satisfiability(3 sat), Reducibility, TSP (Flipped Classroom: Sum of Subsets)	
	Approximation Algorithms: Vertex Cover Problem, Travelling SalesPerson problem	
	Network Approximation: Randomized Rounding, Primal Dual algorithms	
	Randomized Classes: RP, BPP, ZPP (Adleman's theorem)	
	Special Topic: Turing Machine Halting Problem (time and space bounds, nondeterminism), Diagonalization problem.	

Books Recommended:

Text books:

1. Introduction to Algorithms by Thomas H Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, Third Edition.
2. Design and analysis of algorithms by S. Sridhar
3. Horowitz, Sahani and Rajsekaran, ―Fundamentals of Computer Algorithms‖, Galgotia.
4. Harsh Bhasin, Algorithms Design and Analysis, Oxford, 2015.

Reference Books:

1. Rajeev Motwani, Prabhakar Raghavan, Randomized Algorithm, Cambridge University
2. S. K. Basu, Design Methods and Analysis of Algorithm, PHI
3. Vijay V. Vajirani, Approximation Algorithms, Springer.
4. Computational Complexity, Stanford University.

Suggested List of Experiments:

Lab Session	Title
1	Experiment on Amortized Analysis
2	Experiment on Randomized Algorithms (Randomized Quick Sort)
3	Experiment on Advanced Data Structure (Red-black Tree Operations)
4	Experiment on Graph Based Algorithms (Ford Fulkerson Method)
5	Experiment on Online Algorithms (K-Server algorithm)
● Students need to select the problem statement of relevance and provide the implementable solution by selecting appropriate Advance Data structure and Advance Algorithm. ● Also perform Analysis of the same.	

Any other practical covering the syllabus topics and subtopics can be conducted.

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 of course **DJ19CEC602** including the practical performed during laboratory sessions of course **DJ19CEL602**.
2. Oral and practical examination will be of **25 marks**.

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.
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)

Laboratory work will be based on **DJ19CEL602** with minimum 6 experiments to be incorporated.

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

1. Laboratory work (Performance of Experiments): 15 Marks
2. Journal Documentation (Write-up and solution of selected problem statement): 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 B.Tech. in Computer Engineering								Semester : VI		
Course : Information Security								Course Code: DJ19CEC603		
Course : Information Security Laboratory								Course Code: DJ19CEL603		
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 / present ation/ Journal	Total Term work	50
				-	-	25	15	10	25	

Pre-requisite: Knowledge of Programming Basics and Computer Network.

Objectives:

1. To introduce classical encryption techniques and concepts of modular arithmetic and number theory.
2. To explore the working principles and utilities of symmetric cryptographic algorithms.
3. To distinguish symmetric and asymmetric cryptography and explore the working principles and utilities of asymmetric cryptographic algorithms.
4. To understand data integrity and explore the design issues and working principles of various authentication protocols, PKI standards and various secure communication standards
5. To understand network and system attacks and develop utility programs for secure communication.
6. To explore Software vulnerability and develop and apply preventive measures.

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

1. Understand system security goals and concepts, classical encryption techniques and acquire fundamental knowledge on the concepts of modular arithmetic and number theory.
2. Understand, compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication
3. Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
4. Apply different digital signature algorithms to achieve authentication and design secure applications
5. Understand network security basics, analyze different attacks on networks and systems.
6. Understand Software vulnerability and Apply preventive measures.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction and Number Theory** Services, Mechanisms and attacks-the OSI security architecture-Network security model classical Encryption techniques (Symmetric cipher models, substitution techniques, transposition Techniques), Number theory Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm-Finite fields-Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem, Chinese Remainder theorem.	07
2	**Symmetric Cryptography:** Block cipher principles block cipher modes of operation, Simplified Data Encryption Standard (DES), DES, Double DES, Triple DES, Simplified Advanced Encryption Standard (S-AES), AES- Blowfish, IDEA.	07
3	**Asymmetric Cryptography:** Symmetric vs. Asymmetric Cryptography, Principles of public key cryptosystems, and Essential Number Theory for Public-Key Algorithm: Euclidean algorithm, Extended Euclidean Algorithm, Euiler's Phi Function, Fermat's Little Theorem and Euiler's Theorem. The RSA algorithm, Key management, Diffie Hellman Key exchange, Elliptic curve arithmetic, Elliptic curve cryptography.	08
4	**Integrity, Authentication and Digital Certificates:** Cryptographic hash functions, Properties of secure hash function, MD5, SHA-1, MAC, HMAC, CMAC. User Authentication and Entity Authentication, One-way and mutual authentication schemes, Needham Schroeder Authentication protocol, Kerberos Authentication protocol. RSA Signature Schemes, Elgamal Digital Signatures, Digital Signature Algorithm. Digital Certificate: X.509, PKI.	07
5	**Network Security:** Network security basics: TCP/IP vulnerabilities (Layer wise), Packet Sniffing, ARP spoofing, port scanning, IP spoofing, TCP syn flood, DNS Spoofing. Denial of Service: Classic DOS attacks, Source Address spoofing, ICMP flood, SYN flood, UDP flood, Distributed Denial of Service, Defenses against Denial-of-Service Attacks. Internet Security Protocols: SSL, IPSEC, Secure Email: PGP, Firewalls, IDS and types, Honey pots, Case Study on Network Security.	08

6	**Software Security**	05
	Software Vulnerabilities: Buffer Overflow, Salami Attack, Format string, cross-site scripting, SQL injection, Malware: Viruses, Worms, Trojans, Logic Bomb, Bots, Rootkits Introduction to Secured Software Development Life Cycle. , Case Study on Software Security.	

Books Recommended:

Text books:

1. William Stallings, Cryptography and Network Security, Principles and Practice, 7thEdition, Pearson Education, June 2017.
2. Behrouz A. Ferouzan, —Cryptography & Network Security, Tata Mc Graw Hill, 2007

Reference Books:

1. Applied Cryptography, Protocols Algorithms and Source Code in C, Bruce Schneier, Wiley.
2. Charles Pfleeger, Shari Lawrence Pfleeger & Jonathan Margulies, Security in Computing, 5th Edition, Prentice Hall

3. Secured Development Life Cycle by Michael Howard, Steve Lipner , Microsoft Press.

List of Laboratory Experiments: (Any Seven)

Sr. No.	Title of the Experiment
1	Design and Implement Caesar cipher cryptographic algorithm by considering letter [A..Z] and digits [0..9]. Apply Brute Force Attack to reveal secret.
2	Design and Implement Encryption and Decryption algorithm using Simple Columnar Transposition cipher technique. Study how dictionary attack can be applied on it.
3	Design and Implement your "own" cipher combining "Substitution" and "Transposition" techniques.
4	Implement RSA Cryptosystem using RSA Algorithm / Implement Elliptical Curve Digital Signature Algorithm (ECDSA).
5	Demonstrate the data integrity using various cryptographic algorithms viz. MD-5, SHA-1 using VLAB, IIT Bombay.
6	Implement registration webpage asking for information along with the password (Strong enough). Store the password in database in encrypted form after adding few salt characters in the password. Verify the strength of password and perform analyses using various attack.

7	Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather information about networks and domain registrars.
8	Study of packet sniffer tools wireshark, : Download and install wireshark and capture icmp, tcp, and http packets in promiscuous mode. Explore how the packets can be traced based on different filters.
9	Implementation of Network Intrusion Detection System using SNORT and IPTABLE
10	Implement DOS Attack using HPing, Hping3 and other tools.
11	Implement Buffer Overflow Attack using Ollydbg, Splint, Cppcheck

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

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 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 B.Tech. in Computer Engineering	Semester : VI
Course : Big Data Infrastructure	Course Code: DJ19CEEC6011
Course : Big Data Infrastructure Laboratory	Course Code: DJ19CEEL6011

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

Pre-requisite: Databases, Python ,Java,R, Linux OS

Course Objectives:

1. To define big data solutions for business intelligence.
2. To analyse business case studies for big data analytics.
3. To develop map-reduce analytics using Hadoop and related tools.
4. To perform data storage and management using NoSqL.
5. To perform realtime analysis on streaming data.

Outcomes: Students will be able to

1. Describe big data and use cases from selected business domains.
2. Perform map-reduce analytics using Hadoop.
3. Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics
4. Build and maintain reliable, scalable, distributed systems using Apache Spark.
5. Design and build MongoDB based Big data Applications and learn MongoDB query language.
6. Use streaming tools for real time analysis of bigdata.

	Detailed Syllabus: (unit wise)	
Uni t	**Description**	**Duration**
1	**Introduction to Big Data and Hadoop** ● Introduction to Big Data ● Distributed file system ● Big Data characteristics, Drivers, types of Big Data, ● Traditional vs. Big Data business approach, ● Case Study of Big Data Solutions. ● Bigdata Applications ● Societal and Ethical issues associated with the use of big data analytics ● The key privacy issues.	02
2	**INTRODUCTION TO HADOOP AND HADOOP ARCHITECTURE** ● Big Data – Apache Hadoop & Hadoop EcoSystem ● Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce Concept of Hadoop ● HDFS Commands ● MApReduce-The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution	08
3	**HDFS, HIVE AND HIVEQL, HBASE** ● HDFS-Overview, Installation and Shell, Java API; ● Hive Architecture and Installation, Comparison with Traditional Database, HiveQL Querying Data, Sorting And Aggregating, ● Map Reduce Scripts, Joins & Sub queries ● HBase concepts, Advanced Usage, Schema Design, Advance Indexing, PIG-Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts ● Zookeeper , how it helps in monitoring a cluster ● Build Applications with Zookeeper and HBase	12
4	**SPARK** ● Introduction to Data Analysis with Spark ● Downloading Spark and Getting Started ● Programming with RDDs ● Machine Learning with MLlib.	06
5	**NoSQL** ● Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, Use of NoSQL in Industry, SQL vs NoSQL, ● Introduction to MongoDB key features:	08

	● Core Server tools, MongoDB through the JavaScript's Shell, Creating and Querying through Indexes, Document-Oriented, principles of schema design, Constructing queries on Databases, collections and Documents , MongoDB Query Language.	
6	**Processing of Real Time Data and Streaming Data** ● Data Streams: Introduction and Ingestion ● Kafka ● Storm & Storm Assignment ● Spark Streaming	06

Books Recommended:

Text Books

1. Understanding Big data - Chris Eaton,Dirk derooset al. McGraw Hill
2. MongoDB in Action - Kyle Banker,Piter Bakkum, Shaun Verch, Dream tech Press
3. Beginning Apache Pig-Big Data Processing Made Easy-Balaswamy Vaddeman, Apress'
4. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
5. Eric Sammer, "Hadoop Operations", Reilly, 2012.

Reference Books

1. Paul Zikopoulos, Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Understanding *Big Data: Analytics for Enterprise Class Hadoop and streaming Data*,The McGraw-Hill Companies, 2012.
2. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
3. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
4. Alan Gates, "Programming Pig", O'Reilley, 2011

Suggested List of Experiments:

Sr. No.	Title of the Experiment
1.	Installation of Hadoop on a single node cluster
2.	Execution OF HDFS Commands.
3.	Execution of MapReduce program for sorting of numbers and counting word occurrences in a text file.
4.	Execute HIVE commands to load, insert, retrieve, update, or delete data in the tables.
5.	Execute PIG built in commands and rum pig scripts on HDFS
6.	Installation and Configuration of Apache Spark
7.	Execution of ML algorithms using Apache Spark Mlib

8.	Perform CRUD Operations using Mongodb
9.	Read streaming data using Kafka.
10.	Perform Twitter Sentiment analysis usinfg Spark Streaming

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus, summing up to 75 marks.

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

Laboratory:

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 the two tests will be considered for final grading.

Laboratory: (Term work)

Laboratory work will be based on **DJ19CEEC6011** with minimum 06 experiments along with a mini project to be incorporated.

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

1. Laboratory work (Performance of Experiments): 15 Marks
2. 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 B.Tech. in Computer Engineering								Semester : VI		
Course : Internet of Things								Course Code: DJ19CEEC6012		
Course : Internet of Things Laboratory								Course Code: DJ19CEEL6012		

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

Pre-requisite: Basics of python programming, Computer Networks

Course Objectives:

1. Provide an overview of concepts, trends and challenges of Internet of Things.
2. Impart the knowledge of sensors and embedded systems.
3. Describe IoT deployment levels and M2M technologies
4. Facilitate use of hardware and software technologies related to Internet of Things.
5. Provide the knowledge of IoT communication models and protocols.
6. Develop skills to relate the IoT technologies for practical IoT applications.

Outcomes: At the end of the course, learner will be able to

1. Comprehend the Internet of Things concepts and investigate the challenges.
2. Gain knowledge of sensors and embedded systems.
3. Develop and deploy IoT system prototype with enhanced IoT Technologies.
4. Get hand-on exposure to different IoT processors and controllers
5. Use IoT communication models and protocols.
6. Design and develop small IoT applications to create smart objects

	Detailed Syllabus: (unit wise)	
Unit	**Description**	**Duration**
1	**Introduction to WSN and IoT:** Introduction to WSN and its Technologies, Architecture and characteristics of WSN, Scalability issues and challenges of a Wireless Sensor Network Introduction to Internet of Things, Characteristics and applications of IoT, IoT Reference Model, Security issues in the IoT, Disambiguation of IoT vs IoE vs M2M vs others	04
2	**Transducers, Sensors and Actuators:** Introduction and classification of Transducers, Sensors and Actuators, Types of Sensors: Motion Detectors, Occupancy Detectors, Force Sensors, Strain Sensors, Tactile sensors, Pressure sensors, Chemical sensors, Temperature Sensors etc. Types of Actuators, Solenoid, Voice Coil, DC Motor, AC Motor and Stepper motor, Embedded systems: Characteristics of Embedded Systems	05
3	**Introduction to Arduino and Raspberry Pi:** Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board and its types, Introduction to Embedded C and Arduino platform Introduction to Raspberry Pi, Comparison of various Rpi Models, Understanding SoC architecture and SoCs used in Raspberry Pi, Pin Description of Raspberry Pi, On-board components of Rpi	08
4	**IoT model and protocols:** IoT Levels & Deployment Templates, IoT Level 1, IoT Level 2, IoT Level 3, IoT Level 4, IoT Level 5, IoT Level 6, M2M, Various operating systems, TinyOS, Contiki OS, MANTIS, Protocol Classification, MQTT, XMPP, DDS, AMQP, COAP, REST, IPv6, 6LoWPAN, Comparison of protocols IoT Routing Protocols, Data-centric and Flat-Architecture Protocols, Flooding, Gossiping, Sensor Protocols for Information via Negotiation (SPIN), SPIN PP, SPIN EC (Energy Conserve), SPIN BC, Hierarchical Protocols, LEACH, QoS-Based Protocols	10
5	**IoT applications :** **IoT for Entertainment and wearables:** Bluetooth Headset, Fitness, Smart Watch, location and Tracking – Personal navigation Device **IoT for Manufacturing:** Flow Optimization, Real Time Inventory, Asset Tracking Process, Analytics (pH, Gas, Concentration, Force& Humidity)- portable data terminal, **IoT for Employee safety** – Fire and safety detector, Predictive Maintenance, Firmware Updates, **IoT for healthcare** : Remote Monitoring-ECG, Ambulance Telemetry, Drug Tracking, Hospital Asset Tracking, Access Control, Predictive Maintenance, **IoT for Logistics & Supply chain**. Retail Supply chain control, NFC Payment, Intelligent shopping application, Smart product management, Case studies on Smart cities, Smart Home, Smart Environment, Smart Agriculture	08

6		05
	IoT in Cloud, Fog and Edge Computing: Overview of Cloud and Fog Computing, Definition, Difference between Fog and Cloud, Related Paradigms and Technologies like MCC, MEC, Edge Computing, Taxonomy of Fog Computing, Different dimensions of Fog computing Advantages and Applications. Edge Computing: Architecture of Edge Computing, Benefits, Applications, Cloud, Fog and Edge Computing Use Case Scenarios for IoT	
7		05
	Artificial Intelligence in IoT **Applications of Artificial Intelligence in Internet of Things,** Real world examples: Tesla Motors – Self Driving Cars, WildTrack – Endangered Species Preservation, Nest Labs – Smart thermostat, Automated vacuum cleaner – iRobot Roomba **IoT companies and vendors:** Commercially available IoT devices from vendors, Google Home Voice Controller, Amazon Echo Plus Voice Controller, August Doorbell Cam, August Smart Lock	

Books Recommended:

1) Internet of Things by Srinivasa K.G., Siddesh G.M., Hanumantha Raju R., CENGAGE publication (Text Book)

2) Internet of Things: A Hands-On Approach by Arshdeep Bahga and Vijay Madisetti, Universities Press

3) Internet of Things, Architecture and Design Principles by Raj Kamal, Mc Graw Hill Education

Suggested List of Experiments:

Sr. No.	Title of the Experiment
Arduino	
1.	LED glow
2.	Traffic signal
3.	Seven segment display
4.	Piezo sensor
5.	Light emission
6.	PIR sensor
7.	IR remote control sensor
8.	Ultrasonic sensor
9.	ESP8266 WiFi Module

10.	ThingSpeak Platform
11.	Blynk App
12.	Working with Own Cloud Server (Hosting)
13.	Creating a platform to control home appliances with own server
	R-Pi
1.	Varying the brightness of LED using R-pi
2.	Making a user interface to Turn Things On and Off
3.	Controlling GPIO Outputs using a Web Interface
4.	Create an user interface to control Servo motor
5.	Camera Interfacing and Programming
6.	Playing an Audio File
7.	GSM/GPS interfacing and programming
8.	Measuring distance
9.	Displaying sensor values
10.	Logging to a USB flash Drive

Evaluation Scheme:

Semester End Examination (A):

Theory:

> 1. Question paper 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 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)

Laboratory work will be based on **DJ19CEEL6012** with minimum 10 experiments to be incorporated.

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 B.Tech. in Computer Engineering							Semester : VI			
Course : Business Analytics							Course Code: DJ19CEEC6013			
Course : Business Analytics Laboratory							Course Code: DJ19CEEL6013			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
				Theory			Term Test 1	Term Test 2	Avg.	
Lectures	Practical	Tutorial	Total Credits	75			25	25	25	100
				Laboratory Examination			Term work			Total Term work
3	2	-	4	Oral	Practical	Oral &Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		50
				25	-	-	15	10	25	

Pre-requisite: Basic statistics and Database

Course Objectives: Students will try to:
    1. Business Analytics refers to skills, practices and techniques used in converting data into   information and knowledge that aid business decision making.
    2. Statistical learning including quantitative, qualitative analysis techniques
    3. The use of the above analysis and visualization to aid decision making.

Outcomes: Students will be able to
    1. Able to familiar with Base SAS programming.
    2. Understand and demonstrate visual analytics.
    3. Able to design the report using reporter
    4. View various reports using different media devices.

Unit	Description	Duration
Detailed Syllabus: (unit wise)		
1	**Introduction to Base SAS:** **SAS Program :** Introduction to SAS program, Submitting a SAS program – SAS Studio, SAS Enterprise Guide, SAS Windowing environment, SAS program syntax **Accessing Data :**Examining SAS Data sets, Accessing SAS Libraries **Producing Detail Reports:** Subsetting Report data, Sorting and Grouping Report data, Enhancing Reports **Formatting Data Values:** Using SAS Formats, User defined Formats	08
2	**Reading SAS Dataset , Spreadsheet and Database data** Reading SAS Dataset. Customize SAS Dataset. Router Reading Spreadsheet data Reading database data.	05
3	**Visual Analytics** Getting Stated with SAS Visual Analytics: Exploring SAS VA concepts, Using Home page Administrating the Environment and Managing Data: Exploring Data Builder, Exploring Administrator. Demonstrations and Exercises.	04
4	**Using the Explorer** Selecting Data and defining Data Item properties Creating Visualisations, Enhancing Visualisations with Analytics Interacting with Visualizations and Explorations	08
5	**Designing Reports with Reporter** Creating a Simple Report Creating Data Items and Working with Graphs Working with Filters and Report sections Working with other objects Demonstrations and Exercises	08

6	**Viewing SAS VA Reports and Case Study**	06
	Creating Analyses and Reports.	
	Viewing Reports on the Web	
	Viewing Reports on the Mobile Device/ Office Analytics	
	Case Study – Creating Analyses and Reports	

Books Recommended:
1. SAS programming 1 – Essentials.
2. SAS Visual Analytics – Fast Track.
3. SAS Support

Suggested List of Experiments:

Sr. No.	Title of the Experiment
1.	Importing data in SAS from Excel and CSV file.
2.	Creating summary statistical data.
3.	Exporting results to Excel and PDF.
4.	Manipulating data with functions.
5.	Using data with formats like charts and graphs.
6.	Creating data by applying filters and performing data analysis on it.
7.	Working with graph level display rules.
8.	Analyzing a Text data source.

Evaluation Scheme:

Semester End Examination (A):
Theory:
  1. Question paper 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 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 the two tests will be considered for final grading.

Laboratory: (Term work)

    Laboratory work will be based on **DJ19CEEL6013** with minimum 06 experiments along with a mini project to be incorporated.

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

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

    2. 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 B.Tech. in Computer Engineering								Semester : VI		
Course : Machine Learning								Course Code: DJ19CEEC6021		
Course : Machine Learning Laboratory								Course Code: DJ19CEEL6021		
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	
3	2	-	4	Oral	Practical	Oral &Practical	Laboratory Work	Tutorial / Mini project / presentation / Journal		50
				25	-	-	15	10	25	

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

Course Objectives:

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

Outcomes: Students will be able to

1. Gain knowledge about basic concepts of Machine Learning
2. Identify machine learning techniques suitable for a given problem
3. Apply Dimensionality reduction techniques.
4. Solve the problems using various machine learning techniques
5. Understand the basics of Reinforcement and deep learning.
6. Design application using machine learning techniques

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Machine Learning** Types of Machine Learning, Issues in Machine Learning, Application of Machine Learning, Steps involved in developing a Machine Learning Application.	05
2	**Learning with Regression and trees:** Learning with Regression: Linear Regression, Logistic Regression. Learning with Trees: Decision Trees, Constructing Decision Trees using Gini Index, Classification and Regression Trees (CART).	07
3	**Dimensionality Reduction:** Dimensionality Reduction Techniques: Principal Component Analysis, Independent Component Analysis, Single value decomposition,	07
4	**Learning with Classification and Clustering** **Learning with Classification**: **Artificial Neural Networks-** Backpropagation Algorithm, Self-Organizing Maps **Non-parametric classification:** K Nearest Neighbour Algorithm **Support Vector Machine:** Maximum Margin Linear Separators, Quadratic Programming solution to finding maximum margin separators, Kernels for learning non-linear functions. **Bayesian belief Networks:** Markov Models, Markov Chain Monte Carlo Methods, , Markov Random Fields, Hidden Markov Models **Learning with Clustering:** K-means clustering, Hierarchical clustering, Expectation Maximization Algorithm Supervised learning after clustering, Radial Basis functions.	12
5	**Reinforcement and Deep Learning** **Reinforcement Learning:** Introduction, Elements of Reinforcement Learning, Model based learning, Temporal Difference Learning, Generalization, Partially Observable States**.** **Deep Learning:** Introduction to Deep Neural Network, Wide Vs. Deep Neural Network, Reasons to opt for deep neural network, Deep Neural networks for unsupervised learning	05
6	**Applications of Machine Learning** Recommender Systems, Machine Learning for Image Recognition, Sentiment Analysis, Machine Learning for video surveillance	04

Books Recommended:

Text Books

1. Peter Harrington ―Machine Learning In Action‖, DreamTech Press
2. Ethem Alpaydın, ―Introduction to Machine Learning‖, MIT Press
3. Tom M.Mitchell ―Machine Learning‖ McGraw Hill
4. Stephen Marsland, ―Machine Learning An Algorithmic Perspective‖ CRC Press
5. Kevin P. Murphy , Machine Learning ― A Probabilistic Perspective‖
6. Andreas C. Müller and Sarah Guido- Introduction to Machine Learning with Python: A Guide for Data Scientists,O'reilly
7. François Chollet, Deep Learning with Python| Manning
8. J.-S.R.Jang "Neuro-Fuzzy and Soft Computing" PHI 2003.

Reference Books

1. Han Kamber, ―Data Mining Concepts and Techniques‖, Morgann Kaufmann Publishers
2. Margaret.H.Dunham, ―Data Mining Introductory and Advanced Topics‖, Pearson Education

Suggested List of Experiments:

Sr. No.	Title of the Experiment
1.	To implement Linear Regression
2.	To implement Logistic Regression
3.	To implement CART decision tree algorithm.
4.	To implement Support Vector Machine.
5.	To implement Bayesian Classification.
6.	To implement PCA.
7.	To implement K-Nearest Neighbour.
8.	To implement Radial basis functions.
9.	Mini project based on any machine learning application.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper 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 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 the two tests will be considered for final grading.

Laboratory: (Term work)

Laboratory work will be based on **DJ19CEEL6021** with minimum 06 experiments along with a mini project to be incorporated.

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

1. Laboratory work (Performance of Experiments): 15 Marks
2. 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 B.Tech. in Computer Engineering						Semester: VI				
Course: Compiler Design						**Course Code: DJ19CEEC6022**				
Course: Compiler Design Laboratory						**Course Code: DJ19CEEL6022**				
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**	
3	**2**	**-**	**4**	**Oral**	**Practical**	**Oral &Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**		50
				25	-	-	15	10	25	

Pre-requisite: Data Structures and Algorithms, Theory of Computation

Course Objectives:

1. To initiate an understanding of compilers in general and in brief about phases of compiler.
2. To provide a theoretical framework for optimizing the code.
3. To familiarize and encourage the students to use various compiler construction tools.

Outcomes: On successful completion of course learner will be able to:

1. Understand the basics of compilation steps.
2. Apply knowledge of automata theory and formal languages.
3. Understand and Implement a Parser.
4. Describe techniques for intermediate code and machine code optimization.
5. Apply various Error Recovery mechanisms.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to compilers:** Compilers Analysis of source Program, the tasks of a compiler Analysis of the Source Program, Phases and Passes in compilers, The Grouping of phases Cousins of the compiler, Compiler - construction tools **Introduction to Interpreters:** Phases of interpreter, Types of interpreter, Compiler vs. Interpreter	04
2	**Lexical Analysis:** Role of a Lexical analyser Input buffering, specification and recognition of tokens Designing a lexical analyser generator, Pattern matching based on NFA's.	04
3	**Syntax Analysis:** Role of Parser Top--down parsing, Predictive parsers -(LL) Bottom-Up parsing, Operator precedence parsing, SLR, CLR and LALR parsers.	10
4	**Syntax directed Translation:** Syntax directed definitions, Inherited and Synthesized attributes, Evaluation order for SDDs,S - attributed Definitions, L- attributed Definitions	04
5	**Intermediate code generation:** Intermediate Code types: Postfix, Parse tree and syntax tree, Three address code. Types of Three address code: Quadruples, Triples and Indirect triples Translation of Assignment statements, Boolean expression, case statements, array references and procedure calls.	06
6	**Code generation:** Issues in the design of Code Generator, Basic Blocks and Flow graphs, Code generation algorithm, DAG representation of Basic Block.	04
7	**Code optimization:** Principal sources of Optimization Optimization of Basic Blocks, Loops in Flow graph, Peephole Optimization	04
8	**Run-time storage management:** Data Structures for symbol table, representing scope information, Error detection and recovery, Error handling Storage allocation strategies, parameter passing, introduction to garbage collection and compaction	06

Books Recommended:

Text Book:

1. A. V. Aho, R. Shethi, Monica Lam, J.D. Ulman: Compilers Principles, Techniques and Tools, Pearson Education, Second Edition.

Reference books:

1. Lex & yacc, 2nd Edition by John R. Levine, Tony Mason & Doug Brown O 'Reilly

2. Compiler construction: principles and practices, Kenneth C.Louden ,CENGAGE Learning

Suggested List of Experiments:

Sr. No.	Title of Experiments
1.	Develop a lexical analyzer to recognize a few patterns in c (ex. Identifiers, constants, comments, operators etc.)
2.	Implementation of lexical analyzer using lex tool.
3.	Derive First and Follow of a variable.
4.	Design LL (1) Parser.
5.	Implementation of Intermediate code generation. 1. Assignment statement 2. Boolean statement 3. Loop
6.	Implementation of code generator algorithm
7.	Implementation of code optimization techniques (constant folding etc.)
8.	Case study: LLVM

Evaluation Scheme:

Semester End Examination (A):

Theory:

     1. Question paper 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 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 papers is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Laboratory work will be based on **DJ19CEEL6022** with 10 experiments to be incorporated including 07 from the above suggested list.

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 B.Tech. in Computer Engineering							Semester: VI				
Course: Human Machine Interaction							Course Code: DJ19CEEC6023				
Course: Human Machine Interaction Laboratory							Course Code: DJ19CEEL6023				

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

Prerequisite: Web Technologies; Experience in designing interfaces for applications and web sites. Basic knowledge of designing tools and languages like HTML, Java, etc

Course Objectives: At the end of the course, students will be able to –

1. Learn the foundation of human machine interaction.

2. Understand the importance of human psychology in designing good interfaces.

3. Be aware of mobile interaction design and its usage in day – to – day activities.

4. Understand various design technologies to meet user requirements.

5. Encourage to indulge into research in Machine Interaction Design.

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

1. Identify User Interface (UI) design principles.

2. Analysis of effective user friendly interfaces.

3. Apply Interactive Design process in real world applications.

4. Evaluate UI design and justify.

5. Create application for social and technical task.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**FOUNDATIONS OF HMI:** The Human: History of User Interface Designing, I/O channels, Hardware, Software and Operating environments, The Psychopathology of everyday Things, Psychology of everyday actions, Reasoning and problem solving . The computer: Devices, Memory, processing and networks. Interaction: Models, frameworks, Ergonomics, styles, elements, interactivity, Paradigms.	7
2	**DESIGN & SOFTWARE PROCESS:** Mistakes performed while designing a computer system, Human interaction with computers, importance of human characteristics, human consideration, Human interaction speeds .Interactive Design basics, process, scenarios, navigation, Iteration and prototyping. HMI in software process: software life cycle, usability engineering, Prototyping in practice, design rationale. Design rules: principles, standards, guidelines, rules. Recognize the goals, Goal directed design process. Evaluation Techniques: Universal Design.	8
3	**GRAPHICAL USER INTERFACE:** The graphical User Interface: Popularity of graphics, the concept of direct manipulation, graphical systems, Characteristics. Web user Interface: Interface popularity, characteristics. The merging of graphical Business systems and the Web. Principles of user interface design.	6
4	**SCREEN DESIGNING**: Design goals , Screen planning and purpose, organizing screen elements, ordering of screen data and content , screen navigation and flow, Visually pleasing composition, amount of information, focus and emphasis, presentation information simply and meaningfully, information retrieval on web, statistical graphics, Technological consideration in interface design.	7
5	**INTERFACE DESIGN FOR MOBILE DEVICES:** Mobile Ecosystem: Platforms, Application frameworks: Types of Mobile Applications: Widgets, Applications, Games, Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	6
6	**INTERACTION STYLES AND COMMUNICATION:** Windows:Characteristics, Components, Presentation styles, Types of Windows, Management, operations. Text messages: Words, Sentences, messages and text words, Text for web pages. Icons, Multimedia and colors	6

Books Recommended:

Text books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, ―Human Computer Interaction‖, 3rdEdition, Pearson Education, 2004.

2. Wilbert O. Galitz, ―The Essential Guide to User Interface Design‖, Wiley publication.

3. Alan Cooper, Robert Reimann, David Cronin, ―About Face3: Essentials of Interaction design‖,

Wiley publication.

4. Jeff Johnson, ―Designing with the mind in mind‖, Morgan Kaufmann Publication.

5. Donald A. Normann, ― Design of everyday things‖,Basic Books; Reprint edition 2002.

6. Brian Fling, ―Mobile Design and Development‖, First Edition , O'Reilly Media Inc., 2009.

Reference Books:

1. Rogers Sharp Preece,‖Interaction Design:Beyond Human Computer Interaction‖,,Wiley.

2. Guy A. Boy ―The Handbook of Human Machine Interaction‖, Ashgate publishing Ltd.

3. Kalbnde,Kanade,Iyer,‖Galitz's Human Machine Interaction‖, Wiley Publications.

Suggested List of Experiments:

Sr. No.	Title of Experiments
1.	Design a Mobile app/ Website that can teach mathematics to children of 4-5 years age in schools in Rural /Urban Sector
2.	Design a Mobile App/Website that can help people to sell their handmade products in metro cities
3.	ATM machine/KIOSK screen design for rural people.
4.	Design a Mobile App/Website to get an experience for passengers whose flight /train is delayed.
5.	Design an UI application for Institute event management.
6.	Design of User interface for the system using various interaction styles.
7.	Statistical Graphics and its use in visualization
8.	Design appropriate icons pertaining to a given domain .(Eg. Greeting cards)
9.	Design UI for Motor paralysis for disabled people.
10.	KIOSK design for hospital/school/educational campus/National Institute.

Evaluation Scheme:

Semester End Examination (A):

Theory:

     1. Question paper 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 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 the two tests will be considered for final grading.

Laboratory: (Term work)

Laboratory work will be based on **DJ19CEEL6023** with minimum 08 experiments to be incorporated.

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.

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Program: Third Year B.Tech. in Computer Engineering							Semester : VI			
Course : Innovative Product Development-IV							Course Code: DJ19ILL2			
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	
--	02	--	01	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		50
				25	--		--	--	25	

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.

Outcome:

Learner will 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 theteam or as theleader.
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 form a team of 3 to 4 students (max allowed: 5-6 in extraordinary cases, subject to the approval of the department review committee and the Head of the department).
- Students should carry out a survey and identify the need, which shall be converted into conceptualization of a product, in consultation with the faculty supervisor/head of department/internal committee of faculty members.
- Students in the team shall understand the effective need for product development and accordingly select the best possible design in consultation with the faculty supervisor.
- Students shall convert the best design solution into a working model, using various components drawn from their domain as well as related interdisciplinary areas.
- 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 design solution 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 a 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.
- 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 tothe team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.
- Distribution of term work marks during the subsequent semester shall be as given below:
  - Marks awarded by the supervisor based on log-book   : 10
  - Marks awarded by review committee   : 10
  - Quality of the write-up   : 05

In the last review of the semester VI, the term work marks will be awarded as follows.

- Marks awarded by the supervisor (Considering technical paper writing)   : 15
- Marks awarded by the review committee   : 10

Review/progress monitoring committee may consider the following points during the assessment.

- In the semester V, the entire design proposal shall be ready, including components/system selection as well as the cost analysis. Two reviews will be conducted based on the presentation given by the student's team.
  - First shall be for finalisation of the product selected.
  - Second shall be on finalisation of the proposed design of the product.
- In the semester VI, the expected work shall be procurement of components/systems, building of the working prototype, testing and validation of the results based on work completed in semester III.
  - First review is based on readiness of building the working prototype.
  - Second review shall be based on a presentation as well as the demonstration of the working model, during the last month of semester IV. This review will also look at the readiness of the proposed technical paper presentation of the team.

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 IV.Students are compulsorily required to present the outline of the technical paper prepared by them during the final review in semester VI.

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Program: Third Year B.Tech. in Computer Engineering							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

Objectives:

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

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

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

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.	4
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.	4
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.	5

Detailed Syllabus: (unit wise)

Books Recommended:

Text books:

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

Reference Books:

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

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