Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and detailed syllabus (DJ19)

Second Year B.Tech

in

Computer Science and Engineering (Data Science)

(Semester IV)

Revision: 1 (2019)
With effect from the Academic Year: 2020-21

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

Scheme for Second Year B.Tech. Program in Computer Science & Engineering (Data Science): Semester IV

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	DJ19DSC401	Programming Language Principles	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19DSL401	Programming Language Principles Laboratory	--	2	--	1	--	--	--	--	--	--	--	--	--	25	--	25	1	
2	DJ19DSC402	Machine Learning - I	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19DSL402	Machine Learning - I Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	50	50	1	
3	DJ19DSC403	System Fundamentals	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19DSL403	System Fundamentals Laboratory	--	2	--	1	2	--	--	--	25	25	--	--	--	25	50	50	1	
4	DJ19DSC404	Design and Analysis of Algorithms	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19DSL404	Design and Analysis of Algorithms Laboratory	--	2	--	1	2	--	--	--	25	--	--	--	--	25	25	50	1	
6	DJ19IHC1	Universal Human Values	2	--	--	2	3	75	--	--	--	75	25	25	25	--	25	100	2	3
	DJ19IHT1	Universal Human Values Tutorial	--	--	1	1	--	--	--	--	--	--	--	--	--	25	25	25	1	
7	DJ19DSL405	Web Engineering Laboratory		4		2	2				50	50				50	50	100	2	2
8	DJ19A4	Innovative Product Development-II	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			14	**14**	**1**	**21**	**23**	**375**	**50**	**0**	**50**	**475**	**125**	**125**	**125**	**175**	**325**	**800**	**21**	**21**

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

Second Year (Semester IV)
B. Tech.

Computer Science and
Engineering (Data Science)

Syllabus for Second Year Engineering (CSE-Data Science) - Semester IV
(Autonomous) (Academic Year 2021-22)

Program: Third Year B.Tech. in Computer Science and Engineering (Data Science)	**Semester: IV**
Course: Programming Language Principles	**Course Code: DJ19DSC401**
Course: Programming Language Principles Laboratory	**Course Code: DJ19DSL404**

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**	

Pre-requisite: Computer Basics.

Objectives: To introduce various programming paradigms and basic constructs of programming languages with the concepts of syntax and semantics.

Outcomes: On completion of the course, learner will be able
1. Compare different programming paradigms with their design issues.
2. Apply client and server-side scripting to develop applications.
3. Illustrate system programming concepts.

Detailed Syllabus: (unit wise)

Unit	**Description**	**Duration**
1	**Introduction:** Role of Programming Languages, need to study Programming Languages, Characteristics of Programming Languages, Programming language Paradigms: Imperative, Object Oriented, Functional, Logic, Event Driven and Concurrent Programming, Language design issues, Language translation issues. Data Types: properties of Types and objects, Elementary data types, structured data types, Type conversion, Binding and binding times.	04
2	**Imperative Programming Paradigm**: **Procedural Programming:** Sequence Control: Implicit and explicit sequence control, sequencing with arithmetic expressions, sequencing with Nonarithmetic expressions, sequence control between statements. Subprogram control: subprogram sequence control, attributes of data control, shared data in subprograms, different parameter passing methods, lifetime of variables, Storage management, Exceptions and exception handling. Desirable and undesirable characteristics of procedural programming. Case study of C. **Object – Oriented Programming:** General characteristics for object-based programming, Design Principles for object-oriented	08

	programming, Implementing object-oriented programming, desirable characteristics of object-oriented programming. Object Oriented Programming in Java: Abstraction, Inheritance, Polymorphism, I/O, access specification, interfaces, packages, exception handling, multithreading, event handling. AWT: working with windows, Graphics, Text, using AWT controls, layout manager and menus. Comparative study of Java and Python.	
3	**Declarative Programming**: Logic programming language model, logical statements, Resolution, Unification, Search structures, Applications of Logic programming. Case study of Prolog. Applicative programming Paradigm: Lambda calculus: Ambiguity, free and bound identifiers, reductions, typed lambda calculus, principles of functional programming. Case study of Haskell.	08
4	**Overview of Scripting Language**: Common characteristics, Different problem domains for using Scripting, Use of scripting in web development-server and client-side scripting. Innovative features of Scripting Languages-Names and scopes, String and Pattern Manipulating, Data Types, Object Orientation.	04
5	**Syntax and Semantics:** Lexical structure of programming languages, Context-Free Grammars and BNFs, Parse Trees and Abstract Syntax Trees, Ambiguity, Associativity and Precedence, EBNFs and Syntax Diagrams, Parsing techniques and tools, Lexics vs Syntax vs Semantics. Attributes, Binding and Semantic Functions, Declarations, Blocks and Scopes, The Symbol Table, Name Resolution and Overloading, Allocation Lifetime and the Environment, Variable and Constants, Aliases, Dangling References and Garbage	12
6	**Parallel Programming Paradigm:** Principles of parallel programming, precedence graph, data parallelism, control parallelism, message passing, shared address space, synchronization mechanisms, mapping, granularity.	06

Books Recommended:

Text Books:

1. Roosta Seyed, “Foundations of Programming Languages Design & Implementation”, 3rd Edition, Cenage learning.
2. Pratt T.W., Zelkowitz “Programming Languages: Design and Implementation” PHI, 2002, 3rd Edition.ISBN-81-203-1038-1
3. M. Scott, Programming Language Pragmatics, Morgan Kaufmann Publishers

Reference Books:

1. Sebesta R. W., “Concepts of programming languages”, Pearson Education 2001, 4th edition.
2. Sethi Ravi, “Programming Languages: Concepts and Constructs” Pearson Education.
3. Herbert Schildt “The Complete Reference C”, 4th edition, Tata McGraw Hill.
4. Herbert Schildt “The Complete Reference Java2”, 5th edition, Tata McGraw Hill.
5. Graham Hutton, “Programming in Haskell”, 2nd Edition Cambridge University Press
6. John Bloomer, “Power Programming with RPC”, O’Reilly
7. Max Bramer, “Logic Programming with Prolog”, Springer
8. Lutz M, “Learning Python: Powerful Object- Oriented Programming”, 5th edition, O’Reilly

Syllabus for Second Year Engineering (CSE-Data Science) - Semester IV
(Autonomous) (Academic Year 2021-22)

Suggested List of Laboratory Experiments:

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.
At least one program per unit should be covered in the laboratory.

S No	Title of Experiments

1. Procedural Programming:
   a. Write a C program to find whether a triangle can be formed or not. If not display "This Triangle is NOT possible." If the triangle can be formed, then check whether the triangle formed is equilateral, isosceles, scalene or a right-angled triangle. (If it is a right-angled triangle then only print Right-angle triangle do not print it as Scalene Triangle or Isosceles triangle).
   b. Write a C program to sort a given 1D array using pointer in ascending order.
2. Object Oriented Programming:
   a. Implement an application of Encapsulation
   b. Implement an application for different types of Inheritance.
3. Logic Programming: Implement following using PROLOG
   a. Write facts for the given statement.
   b. Write a program to study rule.
   c. Create a family tree.
4. Functional Programming: Implement following using Haskell
   a. Write a function to determine the length of a list.
   b. Write a function to determine if a given item appears in a list.
   c. Write a function to find addition of two number.
   d. Write a program to find the second lowest grade of any student(s) from the given names and grades of each student using lists and lambda. Input number of students, names and grades of each student.
5. Scripting:
   a. Implement string and pattern matching using python/PERL
   b. Design Student Registration form using Java Script/PHP.
6. Syntax and Semantics:
   a. Case study on LEX and YACC Programming.
   b. Write a program to identify Tokens.
   c. Implement Symbol Table.
7. Parallel Programming:
   a. Implement inter process communication using RPC.
   b. Implement inter process communication using Sockets.
   c. Program on multithreading.

Evaluation Scheme:

Semester End Examination (A):

Theory:

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

Laboratory:

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

Continuous Assessment (B):

Syllabus for Second Year Engineering (CSE-Data Science) - Semester IV
(Autonomous) (Academic Year 2021-22)

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 **DJ19DSL401** 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

Syllabus for Second Year Engineering (CSE-Data Science) - Semester IV
(Autonomous) (Academic Year 2021-22)

Program: Second Year B.Tech. in Computer Science and Engineering (Data Science)	**Semester: IV**
Course: Machine Learning - I	**Course Code:DJ19DSC402**
Course: Machine Learning – I Laboratory	**Course Code:DJ19DSL402**

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

Course Objectives:

1. To introduce the concepts of computation learning theory and techniques of Machine Learning.
2. To become familiar with regression, classification and clustering tasks.

Outcomes: Students will be able to

1. Classify given problems into classification, clustering and regression problems
2. Apply machine learning techniques for a given problem
3. Examine the dataset, choose appropriate algorithm and evaluate the results.
4. Design applications using machine learning algorithms

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, Hypothesis and Inductive Bias,	04
2	**Regression:** Linear Regression, Least Minimum Slope (LMS) algorithm, Gradient Descent, Lasso and Ridge Regression. Polynomial Regression. Logistic Regression, Maximum Likelihood Function.	08
3	**Trees:** Introduction to decision tree, Learning Decision tree using ID3 and Gini index; CART, Overfitting. Ensemble methods: Bagging (Random Forest) and Boosting (XG Boost).	08
4	**Classification:** Bayesian Learning, Naïve Bayes, Bayesian Network: Representation in Bayesian Belief Network, Inference in Bayesian Network, Applications of Bayesian Network	06
5	**Introduction to Support Vector Machine:** Support Vectors, Functional Margin, Geometric Margin, Optimization problem, Lagrange Duality, KKT condition, Maximum margin with noise, Non-linear SVM and Kernel Function.	06
6	**Clustering:** K-means, Adaptive hierarchal Clustering, Gaussian Mixture Models, Expectation Maximization,	08

Books Recommended:

Text Books

1. Tom M.Mitchell ―Machine Learning‖ McGraw Hill
2. Peter Harrington ―Machine Learning In Action‖, DreamTech Press
3. Ethem Alpaydın, ―Introduction to Machine Learning‖, MIT Press

Reference Books

1. Han Kamber, ―Data Mining Concepts and Techniques‖, Morgann Kaufmann Publishers
2. Stephen Marsland, ―Machine Learning An Algorithmic Perspective‖ CRC Press
3. Kevin P. Murphy , Machine Learning ― A Probabilistic Perspective‖
4. Andreas C. Müller and Sarah Guido- Introduction to Machine Learning with Python: A Guide for Data Scientists, O'reilly

Weblinks:

1. Towards Data Science: https://towardsdatascience.com
2. Machine Learning — Andrew Ng, Stanford University: https://youtube.com/playlist?list=PLLssT5z_DsK-h9vYZkQkYNWcItqhlRJLN
3. Commonly used Machine Learning Algorithms: https://www.analyticsvidhya.com/blog/2017/09/common-machine-learning-algorithms/
4. A Tour to Machine Learning Algorithms: https://machinelearningmastery.com/a-tour-of-machine-learning-algorithms/

Suggested List of Experiments:

Students should be encouraged to write these programs from scratch to develop better understanding of the algorithms. Last 30 mins of the laboratory should be utilized as a discussion on available python libraries and hyperparameters.

Sr. No.	Title of the Experiments
1.	Perform Linear Regression.
2.	Perform Logistic Regression.
3.	Perform Decision Tree using GINI.
4.	Perform CART decision tree algorithm.
5.	Perform Ensemble methods
6.	Perform Bayesian Classification.
7.	Perform Support Vector Machine.
8.	Perform K-means clustering.
9.	Perform Expectation -Maximization.
10.	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 & Practical examination will be based on the entire syllabus including the practical's performed during laboratory sessions.

Syllabus for Second Year Engineering (CSE-Data Science) - Semester IV
(Autonomous) (Academic Year 2021-22)

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 **DJ19DSL402** with minimum 10 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 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

Syllabus for Second Year Engineering (CSE-Data Science) - Semester IV
(Autonomous) (Academic Year 2021-22)

<table>
<tr><td colspan="8">Program: Second Year B.Tech. in Computer Science and Engineering (Data Science)</td><td colspan="3">Semester: IV</td></tr>
<tr><td colspan="8">Course: System Fundamentals</td><td colspan="3">Course Code: DJ19DSC403</td></tr>
<tr><td colspan="8">Course: System Fundamentals Laboratory</td><td colspan="3">Course Code: DJ19DSL403</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
<tr><td colspan="3">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
<tr><td rowspan="2">Lectures</td><td rowspan="2">Practical</td><td rowspan="2">Tutorial</td><td rowspan="2">Total Credits</td><td colspan="3">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td></tr>
<tr><td colspan="3">75</td><td>25</td><td>25</td><td>25</td><td>100</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">2</td><td rowspan="3">-</td><td rowspan="3">4</td><td colspan="3">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="2">Total Term work</td><td rowspan="2">50</td></tr>
<tr><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td colspan="2">Tutorial / Mini project / presentation/ Journal</td></tr>
<tr><td>--</td><td>--</td><td>25</td><td>15</td><td colspan="2">10</td><td>25</td></tr>
</table>

Pre-requisite: Basic Mathematics

Course Objectives: The objective of this course is to understand the structure, functions and characteristics of computer system and operating systems

Outcomes: Students will be able to

1. Describe the fundamental organization of a computer system.
2. Apply appropriate memory mapping, process scheduling and disk scheduling methods.
3. Identify the need of concurrency and apply appropriate method to solve the concurrency or deadlock problem.
4. Differentiate between various processor architecture.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to System Fundamentals:** Von Neumann model, Fixed point representation, Register Transfer and Micro-operations: Floating point representation, Arithmetic Micro-Operations, Arithmetic logical shift unit. Addition and subtraction, Multiplication Algorithms (Booth Multiplication Algorithm), Division Algorithms, Floating Point Arithmetic operations, **Operating System Architecture:** Basic functions and services, System calls, Types of Operating Systems: Batch, multiprogramming. Multitasking, time sharing, parallel, distributed & real -time O.S. Case Study on Linux OS.	08
2	**Central Processing Unit: I**ntroduction, General Register Organization, Stack Organization, Instruction format, Addressing Modes, data transfer and manipulation, Program Control, Reduced Instruction Set Computer (RISC) **Process Management:** Process Concept, Process states, Process control, Threads, Uni-processor Scheduling: Types of scheduling: Pre-emptive, Non pre-emptive, Scheduling algorithms: FCFS, SJF, RR, Priority.	06
3	**Memory Organization:** Memory Hierarchy, Main Memory, Cache Memory, Memory Mapping, cache coherence, Pentium IV cache organization, ARM cache organization. **Memory Management:** Memory partitioning: Fixed and Variable Partitioning, Memory Allocation: Allocation Strategies (First Fit, Best Fit, and Worst Fit), Fragmentation, Swapping,	08

	Virtual Memory, Paging. Segmentation, Demand paging and Page replacement policies.	
4	**Concurrency control** **Concurrency:** Principles of Concurrency, Mutual Exclusion: S/W approaches, H/W Support, Semaphores, Monitors, Classical Problems of Synchronization: Readers-Writers and Producer Consumer problems and solutions. **Deadlock:** Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Dining Philosopher problem.	10
5	**File and I/O management:** File access methods, I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), RAID, Disk Cache.	04
6	**Advance Computer Architecture:** Characteristics of Multiprocessors, Flynn's taxonomy, Parallel processing architectures and challenges, Hardware multithreading, Multicore and shared memory multiprocessors, Introduction to Graphics Processing Units, Clusters and Warehouse scale computers – Introduction to Multiprocessor network topologies.	06

Books Recommended:

Text Books

1. William Stallings, Computer Organisation and Architecture, Pearson
2. Greg Gagne, Abraham Silberschatz, John Wiley & Sons, Inc. Operating System Concepts, 9th edition Peter B. Galvin,

Reference Books

1. John Hayes, Computer Architecture and Organization, McGrawHill
2. M. Morris Mano, Computer System Architecture, Pearson
3. Andrew S. Tanenbaum and Todd Austin, Structured Computer Organization, Sixth Edition, PHI
4. M. Murdocca & V. Heuring, Computer Architecture & Organization, WILEY
5. Modern Operating Systems -By Andrew S. Tanenbaum (PHI)

Suggested List of Experiments:

Sr. No.	Title of the Experiment
1	Explore the internal commands of Linux and Write shell scripts to do the following: Display top 10 processes in descending order Display processes with highest memory usage. Display current logged in user and logname. Display current shell, home directory, operating system type, current path setting, current working directory. Display OS version, release number, kernel version. Illustrate the use of sort, grep, awk, etc.
2	Implement Booth's multiplication algorithm.
3	Implement Restoring and Non-Restoring division algorithm.
4.	Implement Direct memory mapped cache organization.
5.	Implement Fully associative and set associative cache memory mapping.
6.	Implement various cache/page replacement policies
7.	Implement CPU scheduling algorithms like FCFS, SJF, Round Robin etc.
8.	Implement Best Fit, First Fit and Worst Fit Memory allocation policy.

9.	Implement Producer -Consumer problem with Semaphore.
10.	Implement order scheduling in supply chain using Banker's Algorithm
11.	Implement Disk Scheduling Algorithms.
12.	Implement Multithreading.

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:

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

Continuous Assessment (B):

Theory:

4. 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.
5. Total duration allotted for writing each of the paper is 1 hr.
6. Average of the marks scored in the two tests will be considered for final grading.

Laboratory: (Term work)

Laboratory work will be based on **DJ19DSL403** with minimum 10 experiments to be incorporated.

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

3. Laboratory work (Performance of Experiments): 15 Marks
4. 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

Syllabus for Second Year Engineering (CSE-Data Science) - Semester IV
(Autonomous) (Academic Year 2021-22)

Program: Second Year B.Tech. in Computer Science and Engineering (Data Science)	**Semester: IV**
Course: Design and Analysis of Algorithms	**Course Code: DJ19DSC404**
Course: Design and Analysis of Algorithms Laboratory	**Course Code: DJ19DSL404**

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

Pre-requisite: Data Structures, Mathematics.

Course Objectives: The objective of the course is to introduce important algorithmic design paradigms and approaches for effective problem solving. To analyze the algorithm for its efficiency to show its effectiveness over the others. In addition, the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems will be introduced.

Outcomes: Students will be able to

1. Analyze the performance of algorithms using asymptotic analysis.
2. Solve the problem using appropriate algorithmic design techniques.
3. Able to prove that certain problems are NP-Complete.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Analysis of Algorithm:** The efficient algorithm, Average, Best and worst case analysis, Amortized analysis, Asymptotic Notations, Analyzing control statement, Loop invariant and the correctness of the algorithm.	04
2	**Divide and Conquer Algorithm:** Introduction, Recurrence and different methods to solve recurrence, substitution and hash techniques, multiplying large Integers Problem, Problem Solving using divide and conquer algorithm -Max-Min problem, Large Integer, Matrix Multiplication.	06
3	**Greedy Algorithm:** General Characteristics of greedy algorithms, Problem solving using - Activity selection problem, Elements of Greedy Strategy, Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm), Graphs: Shortest paths, The Knapsack Problem, Job Scheduling Problem, Optimal Merge Pattern, Huffman code, Coin Change problem.	08
4	**Dynamic Programming:** Introduction, The Principle of Optimality, Problem Solving using Dynamic Programming – Calculating the Binomial Coefficient, Making Coin Change Problem, Assembly Line-Scheduling, Knapsack problem, Multistage Graphs, All Pairs Shortest path, Matrix chain multiplication, Longest Common Subsequence, Travelling Salesman problem, OBST, Johnson's Algorithm for flow shop scheduling	10
5	**Backtracking:** Introduction, The Eight queen's problem, Sum of Subsets, Hamiltonian Cycle.	10

	Branch and Bound: Introduction, FIFO BB, LIFO BB, LC BB, Fifteen Puzzle problem, Knapsack problem, Travelling Salesman problem, Job Scheduling. **String Matching:** Introduction, The naive string-matching algorithm, The Rabin-Karp algorithm, String Matching with finite automata, The Knuth-Morris-Pratt algorithm.	
6	**Introduction to NP-Completeness:** The class P and NP, Polynomial reduction, NP-Completeness Problem, NP-Hard Problems. Travelling Salesman problem, Hamiltonian problem, Approximation algorithms	04

Books Recommended:

Text Books

1. S. Sridhar, Design and Analysis of Algorithms, 1st Edition, Oxford Education, 2018.
2. Ellis Horowitz, and Sartaj Sahni, Fundamentals of Computer Algorithms, 2nd Edition, Galgotia, 2012.
3. Steven S Skiena, The Algorithm Design Manual, Springer International Publications

Reference Books

1. Kleinberg and Tardos, "Algorithm Design", 1st Edition, Addison-Wesley, 2006.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, "Introduction to Algorithms", 3rd Edition, The MIT Press, 2009.
3. Aho, Hopcroft, Ullman, "Design and analysis of Algorithm", 1st Edition, Addison-Wesley, 2000.
4. David Harel, "Algorithmics-The spirit of computing", 3rd Edition, Addison-Wesley, 2004.
5. Knuth, "Fundamentals of Algorithms", 3rd Edition, Narosa Publication, 1998.
6. Herbert S. Wilf, "Algorithms and Complexity", 2nd Edition, PHI, 2002.
7. S. E. Goodman and S. T. Hedetniemi, "Introduction to the Design and Analysis of Algorithms", McGraw Hill, 1988.
8. Sara Baase, Allen Van Gelder, "Computer Algorithms Introduction to Design and Analysis", 3rd Edition, Addison-Wesley, 2000.
9. Gilles Brassard, Paul Bratley, "Fundamentals of Algorithmics", 4th Edition, PHI, 2000.
10. Harsh Bhasin, "Algorithms: Design and Analysis", 1st Edition, Oxford, 2015.

Suggested List of Laboratory Experiments: (At least 12 from the given list)

S No	Title of the Experiments
1	Implementations of Quick Sort and Merge Sort.
2	Implementations of Knapsack problem.
3	Implementations of Job Sequencing with deadlines.
4	Implementation of Prims's & Kruskal's method.
5	Implementation of Shortest paths algorithms (Dijkstra's algorithm and Bellman-ford algorithm).
6	Implementation of Multistage graphs (Forward and Backward) algorithm.
7	Implementation of Floyd Warshall Algorithm.
8	Implementation of Matrix Chain Multiplication.
9	Implementation of Optimal binary search tree.
10	Implementation of 0/1-Knapsack.
11	Implementation of Travelling salesperson problem.
12	Implementation of Johnson's Algorithm for 2 machines and 3 machines scenarios.
13	Implementation of Longest Common Subsequence (LCS).
14	Implementation of 8 queen problem.
15	Implementation of Sum of subsets.
16	Implementation of 15 puzzle problem
17	Implementation of Graph coloring
18	Implementation of Travelling salesperson problem using branch and bound.
19	Implementation of 0/1-Knapsack using branch and bound

Syllabus for Second Year Engineering (CSE-Data Science) - Semester IV
(Autonomous) (Academic Year 2021-22)

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:

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

Continuous Assessment (B):

Theory:

7. 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.
8. Total duration allotted for writing each of the paper is 1 hr.
9. Average of the marks scored in the two tests will be considered for final grading.

Laboratory: (Term work)

Laboratory work will be based on **DJ19DSL404** with minimum 12 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 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

Syllabus for Second Year Engineering (CSE-Data Science) - Semester IV
(Autonomous) (Academic Year 2021-22)

<table>
<tr><td colspan="8">Program: Common for all programs</td><td colspan="2">Semester: IV</td></tr>
<tr><td colspan="8">Course: Universal Human Values</td><td colspan="2">Course Code: DJ19IHC1</td></tr>
<tr><td colspan="8">Course: Universal Human Values Tutorial</td><td colspan="2">Course Code: DJ19IHT1</td></tr>
<tr><td colspan="4" rowspan="3">Teaching Scheme
(Hours / week)</td><td colspan="6">Evaluation Scheme</td></tr>
<tr><td colspan="3">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
<tr><td rowspan="2">Lectures</td><td rowspan="2">Practical</td><td rowspan="2">Tutorial</td><td rowspan="2">Total Credits</td><td colspan="3">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td></tr>
<tr><td colspan="3">75</td><td>25</td><td>25</td><td>25</td><td>100</td></tr>
<tr><td rowspan="3">2</td><td rowspan="3">--</td><td rowspan="3">1</td><td rowspan="3">3</td><td colspan="3">Laboratory Examination</td><td colspan="3"></td><td rowspan="3">125</td></tr>
<tr><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td colspan="3">Total Term work (C)</td></tr>
<tr><td>--</td><td>--</td><td>--</td><td colspan="3">25</td></tr>
</table>

Objectives:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society, and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society, and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

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

1. Become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability.
2. Become sensitive to their commitment towards what they have understood (human values, human relationship, and human society).
3. Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Syllabus for Second Year Engineering (CSE-Data Science) - Semester IV
(Autonomous) (Academic Year 2021-22)

Unit	Description	Duration in Hrs
1	**Introduction**: **Need, Basic Guidelines, Content and Process for Value Education** Purpose and motivation for the course. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.	**05**
2	**Understanding Harmony in the Human Being - Harmony in Myself!** Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I am being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Health.	**06**
3	**Understanding Harmony in the Family and Society: Harmony in Human-Human Relationship**. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.	**06**
4	**Understanding Harmony in the Nature and Existence: Whole existence as Coexistence** Understanding the harmony in the Nature 19. Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all pervasive space. Holistic perception of harmony at all levels of existence.	**05**
5	**Implications of the above Holistic Understanding of Harmony on Professional Ethics**: Natural acceptance of human values 23. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order, b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists, and managers, b. At the level of society: as mutually enriching institutions and organizations.	**06**

Books Recommended:

Textbooks:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference books:

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11.India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Evaluation:

Semester End Examination (A):

Theory:

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

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.

Continuous Assessment (C):

Tutorials: (Term work)

1. Term work shall consist of minimum 4activities based on activities suggested.
2. Term work shall carry total 25 marks based on the performance in the tutorials.

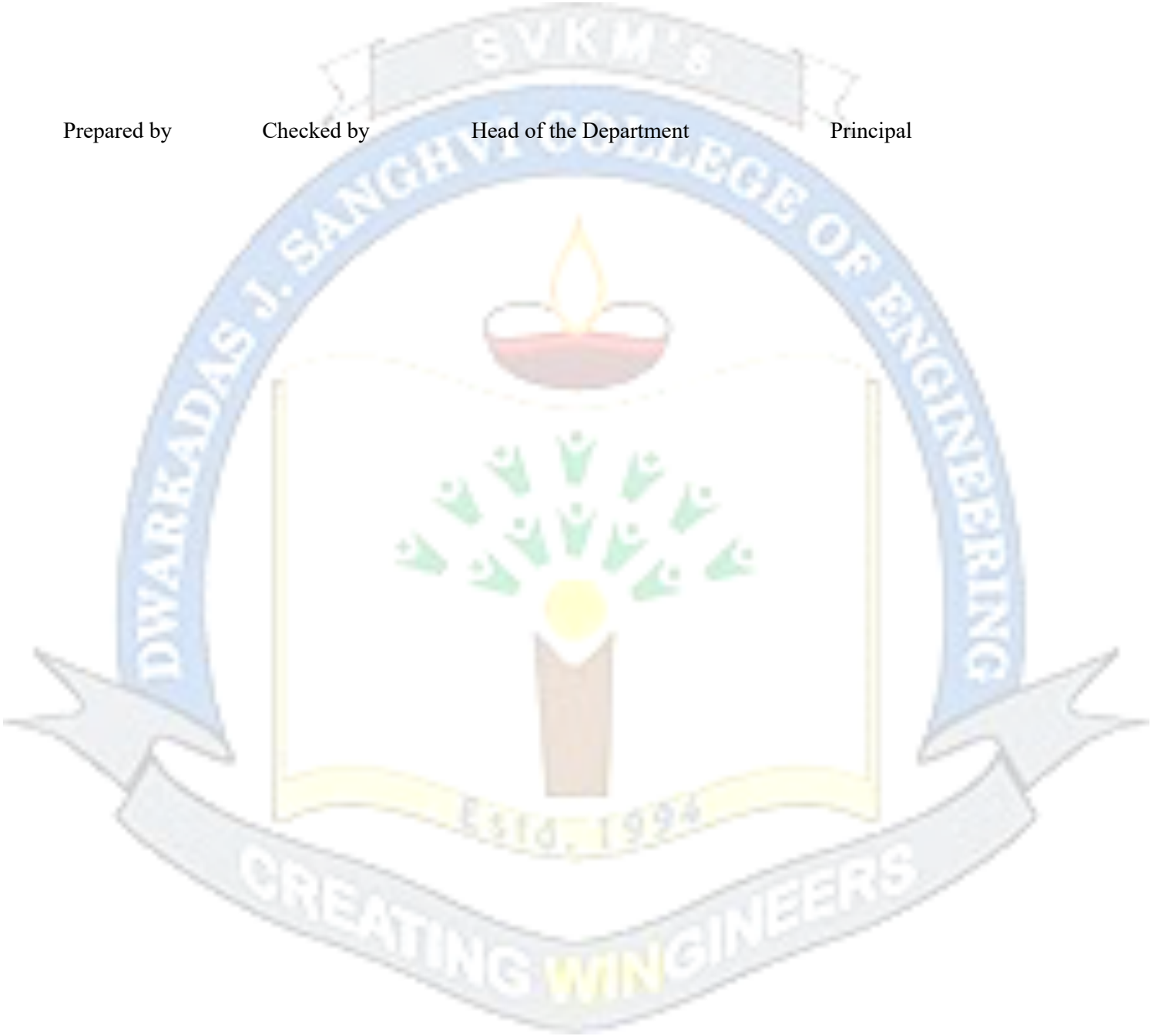
The tutorials could be conducted as per the following topics: -

Activity No 1	Practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony, and co-existence) rather than as arbitrariness in choice based on liking-disliking.
Activity No 2	Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.
Activity No 3	Practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

Activity No 4	Practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.
Activity No 5	Practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. To discuss the conduct as an engineer or scientist etc.

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

Prepared by Checked by Head of the Department Principal



Syllabus for Second Year Engineering (CSE-Data Science) - Semester IV
(Autonomous) (Academic Year 2021-22)

Program: Second Year B. Tech. in Computer Science and Engineering (Data Science)	**Semester: IV**
Course: Web Engineering Laboratory	**Course Code: DJ19DSL405**

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**	
--	4	--	2	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**		**100**
				--	--	50	25	25	50	

Prerequisite: Programming Fundamentals

Objectives: The objective of this lab is to provide the basic framework of web development (MERN Stack) and cloud computing.

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

1. Design a website as per the requirements.
2. Apply the concepts of cloud computing to improve the efficiency of web development.
3. Evaluate the requirement of the problem and select appropriate method of web development.

S No	Detail of the Experiment	No of Hours
1	HTML 1. Create a static web page using HTML. 2. Create a class timetable using HTML. 3. Create a registration form using HTML. 4. Create a web page using HTML5 tags.	2
2	CSS 1. Design a web page using External or Embedded Style Sheet. 2. Design a responsive web page using media queries and CSS3. 3. Design a web page using Bootstrap. 4. Design a resume using Bootstrap. 5. Design the admission form using Bootstrap.	4
3	Client-Side Scripting 1. Programs based on objects in JavaScript. 2. Program to design a calculator using JavaScript. 3. Programs based on form validation.	4

4	React JS 1. Create an application using React. Introduction to Git and GitHub 1. Introduction to Version Control 2. Using Git Locally and Remotely 3. Collaboration	**6**
5	Server-Side Scripting 1. Installation and Configuration of Node.js server 2. Program based on inbuilt functions in Node.js	**4**
6	Express & MongoDB 1. Using Mongoose to make schemas in MongoDB. 2. Making API end points using Express. 3. Doing CRUD on database MongoDB using Express. 4. Writing tests using mocha and chai.	**4**
7	XML & XSL 1. Design XML using XML DTD and schema. 2. Implementing XSL elements in XML. 3. Validating XML data through DTD and storing in database.	**4**
8	Concepts of Cloud Computing 1. Introduction to cloud computing. 2. NIST model 3. Service and Deployment models.	**4**
9	Networking and Security 1. Identity and Access Management 2. Networking basics 3. VPC networking and security 4. Design a VPC 4. Build your own VPC and Launch a Web Server	**4**
10	Compute Service 1. Compute Services overview 2. Elastic Computing 3. Serverless Compute service 5. Deploying and scaling web applications	**4**
11	Storage Service 1. Cloud object storage 2. Cloud block storage 4. Elastic file system	**4**
12	Database Service	**4**

	1. Cloud Relational database services 2. Cloud NoSQL Databases 3. Elastic load balancing	

Books Recommended:

Text books:

1. Vasan Subramanian, "Pro MERN Stack", 2nd Edition, Apress Publication
2. Shama Hoque, "Full-Stack React Projects", 2nd Edition, Packt Publication.
3. Rajkumar Buyya, James Broberg, Goscinki Cloud Computing: Principles and Paradigms, Wiley

Reference Books:

1. *Benjamin LaGrone, "HTML5 and CSS3 Responsive Web Design Cookbook", 1st Edition, Packt Publishing, 2013.*
2. DT Editorial Services, "Web Technologies: Black Book", 1st Edition, Dreamtech Press, 2018.
3. Christopher Schmitt, Kyle Simpson, "HTML5 Cookbook", 1st Edition, O'Reilly Media Inc., 2011.
4. Uttam K. Roy, "Web Technologies", 1st Edition, Oxford University Press, 2010.
5. Greg Sidelnikov, "React. Js Book: Learning React JavaScript Library from Scratch", 1st Edition, Independently Published, 2017.
6. DT Editorial Services, "HTML5 Black Book", 2nd Edition, Dreamtech Press, 2016.
7. Ben Frain, "Responsive Web Design with HTML5 and CSS3", 2nd Edition, Packt Publishing, 2015.
8. Steve Suehring, "JavaScript Step by Step", 3rd Edition, Pearson Education, 2013.
9. Stoyan Stefanov, "React Up Running Building Web Applications", 1st Edition, O'Reilly Media Inc., 2016.
10. *Velte, "Cloud Computing a Practical Approach", Tata McGraw-Hill Education.*
11. Sandip Bhowmik, "Cloud Computing", Cambridge University Press, 2017.

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 and a mini project 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): 25 Marks*
2. *Mini Project:20 Marks*
3. *Attendance (Practical): 05 Marks*

Total: 50 Marks

Prepared by Checked by Head of the Department Principal

Syllabus for Second Year Engineering (CSE-Data Science) - Semester IV
(Autonomous) (Academic Year 2021-22)

<table>
<tr><td colspan="8">Program: Common For all Programs</td><td colspan="3">Semester: III & IV Combined</td></tr>
<tr><td colspan="8">Course: Innovative Product Development-II</td><td colspan="3">Course Code: DJ19A4</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours/week)</td><td colspan="7">Evaluation Scheme</td></tr>
<tr><td colspan="3">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="3">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td></tr>
<tr><td colspan="3">--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td colspan="3">Laboratory Examination</td><td colspan="2">Semester review</td><td rowspan="2">Total</td><td rowspan="3">100</td></tr>
<tr><td rowspan="2">--</td><td rowspan="2">2</td><td rowspan="2">--</td><td rowspan="2">--</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Review 1</td><td>Review 2</td></tr>
<tr><td>--</td><td>--</td><td>--</td><td>50</td><td>50</td><td>100</td></tr>
</table>

Objectives:

1. To acquaint the students with the process of identifying the need (considering a societal requirement) and ensuring
2. that a solution is found out to address the same by designing and developing an innovative product.
3. To familiarize the students with the process of designing and developing a product, while they work as part of a team.
4. 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.
5. To inculcate the basic concepts of entrepreneurship and the process of self-learning and research required to conceptualize 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 conceptualisation 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 III and IV.

Guidelines for Assessment of the work:

- The review/ progress monitoring committee shall be constituted by the Head of the Department. The progress of design and development of the product is to be evaluated on a continuous basis, holding a minimum of two reviews in each semester.
- In the continuous assessment, focus shall also be on each individual student's contribution to the team activity, their understanding and involvement as well as responses to the questionsbeing raised at all points in time.
- Distribution of marks individually for the both reviews as well as for the first review during the subsequent semester shall be as given below:
    - Marks awarded by the supervisor based on log-book : 20
    - Marks awarded by review committee : 20
    - Quality of the write-up : 10

In the last review of the semester IV, the marks will be awarded as follows.

- Marks awarded by the supervisor (Considering technical paper writing) : 30
- Marks awarded by the review committee : 20

Note- A Candidate needs to secure a minimum of 50% marks to be declared to have completed the audit course.

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

- In the semester III, 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 IV, 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 (III and IV) may be based on relevant points listed above, as applicable.

Syllabus for Second Year Engineering (CSE-Data Science) - Semester IV
(Autonomous) (Academic Year 2021-22)

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 IV.

Prepared by Checked by Head of the Department Principal