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)

(Autonomous College Affiliated to the University of Mumbai)

Scheme and detailed syllabus (DJ19)

Third Year B.Tech

in

Computer Science and Engineering (Data Science)

(Semester V)

Revision: 1 (2019)

With effect from the Academic Year: 2022-23

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

Sr	Course Code	Course	Teaching Scheme				Semester End Examination (A						Continuous Assessment (B)					Aggregate (A+B)	Credit	
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Prac	Oral & Pract	End Sem Exam Total	Term Test 1 (TT1)	Term Test 2 (TT2)	Avg (TT1 & TT2)	Termwork	CA Total			
1	DJ19DSC501	Machine Learing - II (Deep Learning)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19DSL501	Machine Learning - II Laboratory	--	2	--	1	2	--	--	--	25	25	--	--	--	25	25	50	1	
2	DJ19DSC502	Artificial Intelligence	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19DSL502	Artificial Intelligence Laboratory	--	2	--	1	--	--	--	--	--	--	--	--	--	25	25	25	1	
3	DJ19DSC503	Information Security	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19DSL503	Information Security Laboratory	--	2	--	1	2	--	--	--	25	25	--	--	--	25	25	50	1	
4	DJ19DSL504	Java and Scala Laboratory	--	4	--	2	2	--	--	--	50	--	--	--	--	50	50	100	1	2
5@	DJ19DSC5011	Distributed Computing	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19DSL5011	Distributed Computing Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19DSC5012	Time Series Analysis	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19DSL5012	Time Series AnalysisLaboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19DSC5013	Digital System Design	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19DSL5013	Digital System Design Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19DSC5014	Probabilistic Graph Models	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19DSL5014	Probabilistic Graph Models Laboratory	--	2	--	1	2	--	25	--	--	25	--	--	--	25	25	50	1	
6	DJ19A3	Environmental Studies	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7	DJ19CEL506	Innovative Product Development -III	--	2	--	1	--	--	--	--	--	--	--	--	--	25	25	25	1	1
		Total	**22**	**20**	**0**	**31**	**35**	**525**	**100**	**0**	**100**	**675**	**175**	**175**	**175**	**250**	**425**	**1150**	**30**	**19**

Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Syllabus of

Third Year (Semester V)
B. Tech.

Computer Science and
Engineering (Data Science)

Program: Third Year B.Tech. in Computer Science and Engineering (Data Science)	Semester: V
Course: Machine Learning -II (Deep Learning)	Course Code: DJ19DSC501
Course: Machine Learning -II Laboratory	Course Code: DJ19DSL501

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

Pre-requisite: Linear Algebra, Calculus, Probability, Statistics and Machine Learning Basics.

Course Objectives:

1. To introduce students with the fundamental concepts of artificial neural network and different learning algorithms: supervised and unsupervised neural networks
2. Develop in-depth understanding of the key techniques in designing Deep Network, Explainable AI and GAN.
3. To expose Deep Network based methods to solve real world complex problems.

Outcomes: Students will be able to

1. Analyze different neural network architectures and their learning algorithms.
2. Implement deep network training and design concepts.
3. Build solution using appropriate neural network models.
4. Illustrate performance of deep learning models using Explainable AI.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Artificial Neural Learning:** History of Deep Learning, Fundamental concepts of biological Neural Networks, Important terminologies of ANN: Activation functions: weights, bias, threshold, learning rate, momentum factor; McCulloch Pitts Neuron: Theory and Architecture; Linear separability; Hebb Network: Theory and Algorithm.	04
2	**Supervised Learning Networks:** Perceptron: Representational power of Perceptron, The Perceptron Training Rule, Gradient Descent and Delta Rule; Multilayer Networks: A differentiable Threshold Unit, Representational Power of Feedforward Networks; Backpropagation Algorithm: Convergence and local minima, Hypothesis space search and Inductive Bias, Generalization, overfitting and stopping criteria. Regularization for Deep Learning: Parameter Norm Penalties, Dataset Augmentation, Noise Robustness, Early Stooping, Sparse Representation, Dropout. Optimization for Training Deep Models: Challenges in Neural network Optimization, Basic Algorithms, Parameter Initialization Strategies.	10

3	**Convolutional Networks:** The Convolution Operation, sparse interactions, parameter sharing, Pooling, Convolution and Pooling as an Infinity Strong Prior, Variants of Basic Convolution Function, Efficient Convolution Algorithms.	**06**
4	**Sequence Modelling:** Recurrent Neural Networks (RNN), Bidirectional RNNs, Deep recurrent Networks, Recursive Neural Networks, The challenges of Long-Term Dependencies, Echo State Networks, Leaky Units, The Long Short-Term Memory.	**06**
5	**Unsupervised Learning Networks:** Kohonen Self-Organizing Feature Maps – architecture, training algorithm, Kohonen Self-Organizing Motor Map. **Autoencoders:** Linear Factor Methods such as Probabilistic PCA and Factor Analysis, Independent Component Analysis, Sparse Coding; Undercomplete Autoencoders, Regularized Autoencoders, Stochastic Encoders and Decoders, Denoising Autoencoders, Contractive Autoencoders, Applications of Autoencoders. **Generative Adversarial Networks:** Generative Vs Discriminative Modeling, Probabilistic Generative Model, Generative Adversarial Networks (GAN), GAN challenges: Oscillation Loss, Mode Collapse, Uninformative Loss, Hyperparameters, Tackling GAN challenges, Wasserstein GAN, Cycle GAN, Neural Style Transfer	**10**
5	**Explainable AI:** Explaining and Interpreting, From black box to white box models, SHAP (Shapley Additive Explanation) and LIME (Local Interpretable Model-agnostic Explanation).	**06**

Books Recommended:

Text Books:

1. Simon Haykin, “Neural Networks and Learning Machines”, Pearson Prentice Hall, 3rd Edition, 2010.
2. S. N. Sivanandam and S. N. Deepa, “Introduction to Soft Computing”, Wiley India Publications, 3rd Edition, 2018.
3. David Foster, “Generative Deep Learning”, O’Reilly Media, 2019.
4. Denis Rothman, “Hands-On Explainable AI (XAI) with python”, Packt, 2020.

Reference Books:

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, “Deep Learning”, An MIT Press, 2016
2. François Chollet, “Deep Learning with Python”, Manning Publication, 2017.
3. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioner's Approach”, O’Reilly Publication, 2017.
4. Andrew W. Trask, Grokking, “Deep Learning”, Manning Publication, 2019.
5. John D. Kelleher, “Deep Learning”, MIT Press Essential Knowledge series, 2019.

Web Links:

1. Learning Rule: http://vlabs.iitb.ac.in/vlabs-dev/labs/machine_learning/labs/explist.php
2. ANN Virtual Lab: http://cse22-iiith.vlabs.ac.in/List%20of%20experiments.html
3. Deep Learning: https://vlab.spit.ac.in/ai/#/experiments
4. NPTEL Course: Deep Learning Part 1: https://onlinecourses.nptel.ac.in/noc19_cs85/preview

Suggested List of Experiments:

Sr. No.	Title of the Experiment
1.	Implement Boolean gates using perceptron.

2.	Implement backpropagation algorithm from scratch.
3.	Monitoring and evaluating deep learning models using Tensorflow and Keras.
4.	Evaluate and analyze Prediction performance using appropriate optimizers for deep learning models.
5.	Implement Sentiment analysis on text dataset to evaluate customer reviews.
6.	Building CNN models for image categorization.
7.	Document classification using RNN models.
8.	Outlier detection in time series dataset using RNN.
9.	Anomaly detection using Self-Organizing Network.
10	Compare the performance of PCA and Autoencoders on a given dataset.
11	Build Generative adversarial model for fake (news/image/audio/video) prediction.
12	Build Explainable AI to improve human decision-making using a two-choice classification experiment with real-world data.

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

Laboratory:

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

Continuous Assessment (B):

Theory:

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

Laboratory: (Term work)

Term Work shall consist of at least 10 practicals based on the above 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, 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 First Year Engineering (All Branches) - Semester II (Autonomous)
(Academic Year 2019-2020)

Program: Third Year B.Tech. in Computer Science and Engineering (Data Science)	**Semester: V**
Course: Artificial Intelligence	**Course Code:DJ19DSC502**
Course: Artificial Intelligence Laboratory	**Course Code:DJ19DSL502**

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

Pre-requisite: Basic Mathematics and Data Structures.

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 expert systems.

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

1. Classify given problem and identify the need of intelligent agent.
2. Apply appropriate search-based method for a given problem.
3. Analyze various AI approaches to knowledge– intensive problem solving, reasoning and planning.
4. Design an expert system for a given AI problem.

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.	**04**

2	**Problem solving:** Solving problem by Searching: Problem Solving Agent, Formulating Problems, and Example Problems. **State Space Search:** Uninformed search, Breadth First Search (BFS), Depth First Search (DFS), Depth Limited Search, Depth First Iterative Deepening (DFID). **Heuristic Search**: Best first Search, Hill Climbing, Solution Space, and Travelling Salesman Problem.	**08**
3	**Population Based Methods**: Simulated annealing, Local beam search, Genetic algorithms, Ant Colony optimization. **Finding Optimal Paths**: Branch and Bound, A*, Admissibility and monotonicity properties of A*. **Game Playing:** Game Theory, Board games and game tree, The minimax algorithm, Alpha-Beta Pruning and SSS*	**08**
4	**Planning**: Domain independent planning, Forward and Backward search, Goal Stack Planning, Plan Space Planning, Means Ends Analysis, Graphplan, algorithm AO*	**06**
5	**Expert System:** Introduction, Phases in building Expert Systems, Architecture, Rule base systems, Inference Engine, Match-Resolve-Execute, Rete Net,	**04**
6	**Knowledge and Reasoning in Logic:** Logic, Soundness and Completeness, Propositional Logic, First Order Logic, Forward chaining, Backward chaining and Refutation. **Uncertain Knowledge and Reasoning:** Fuzzy sets, Fuzzy Logic, Fuzzy Logic Controller	**12**

Books Recommended:

Text Books:

1. Deepak Khemani.” A First Course in Artificial Intelligence”, McGraw Hill Education (India), 2013.
2. Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach”, Fourth Edition, Pearson Education, 2010.
3. John Yen and Reza Langari, "Fuzzy Logic: Intelligence, Control, and Information", Pearson, 2002

Reference Books

1. Saroj Kaushik “Artificial Intelligence”, First Edition, Cengage Learning, 2011.
2. Ivan Bratko “PROLOG Programming for Artificial Intelligence”, Fourth Edition, Pearson Education, 2011.
3. Elaine Rich and Kevin Knight “Artificial Intelligence” Third Edition, Tata McGraw-Hill, 2008.
4. Davis E.Goldberg, “Genetic Algorithms: Search, Optimization and Machine Learning”, Addison Wesley, N.Y.
5. Patrick Henry Winston, “Artificial Intelligence”, Addison-Wesley, Third Edition.
6. N.P.Padhy, “Artificial Intelligence and Intelligent Systems”, Oxford University Press, 2005.

Web Links:

1. Game Theory: https://plato.stanford.edu/entries/game-theory/
2. Fuzzy Logic: https://plato.stanford.edu/entries/logic-fuzzy/
3. AI: https://www.functionize.com/blog/when-is-an-ai-not-an-ai-on-the-intelligent-use-of-ai
4. Logic and Ontology: https://plato.stanford.edu/entries/logic-ontology/

Suggested List of Experiments:

Sr. No.	Title of the Experiment
1.	Study of Intelligent Agents and PEAS for different problems.

2.	Identify and analyze uninformed search Algorithm to solve the problem. Implement BFS/DFS/DFID search algorithms to reach goal state.
3.	Program to implement Local Search algorithm: Hill climbing search.
4.	Program on any natures inspired algorithm to solve a optimization problem in AI
5.	Implement A* search algorithm to reach goal state.
6.	Implement minimax algorithm for a two-player game
7.	Develop a knowledge base using Prolog.
8.	Develop a Rule based System using SWRL on Protégé software.
9.	Implement Fuzzy operations for given input values.
10.	Design a fuzzy logic controller for a given problem.

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 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 **DJ19DSL502** 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 First Year Engineering (All Branches) - Semester II (Autonomous)
(Academic Year 2019-2020)

Program: Third Year B.Tech. in Computer Science and Engineering (Data Science)	**Semester: V**
Course: Information Security	**Course Code: DJ19DSC503**
Course: Information Security Laboratory	**Course Code: DJ19DSL503**

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

Pre-requisite: Computer Basics

Course Objectives: The objective of the course is to introduce indicators of system security, recognize various threats, attacks and vulnerabilities.

Outcomes: Students will be able to

1. Illustrate fundamentals of network design and cryptography.
2. Apply appropriate algorithms to ensure Information security during data transmission.
3. Identify various security vulnerabilities in an existing system.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction:** Cyber Attacks, Need of Security, Security Approaches, Principles of security (confidentiality, authentication, integrity, non-repudiation, access control availability), types of attacks. **Networking Basics:** Local Area Network, Protocols - Network Layer, Transport Layer, and Application Layer.	**10**
2	**Number Theory:** Modulo Arithmetic, Euclid's Algorithm, Fermat's and Euler's Theorem, Chinese Remainder Theorem, Cipher Properties, Substitution Ciphers – Monoalphabetic Ciphers, Polyalphabetic Ciphers, Transposition Ciphers.	**06**
3	**Symmetric Cryptography:** Block Cipher, Fiestel Structure, Block Cipher Modes of Operation, S-DES, Double DES, Triple DES, AES Algorithm.	**08**
4	**Asymmetric Cryptography:** Private Key and Public Key Cryptography, The RSA algorithm, Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Operations, Elliptic Curve Diffie-Hellman (ECDH) Key Exchange Algorithm.	**06**
5	**Integrity and Authentication:** Hashing: Properties of cryptographic hash, message digest, MD-5, SHA-1. Public Key	**06**

	Infrastructure (PKI), One way and mutual authentication, Needham-Schroeder Protocol, Authentication methods, Kerberos Authentication Protocol, Biometrics, Digital Certificates: X.509.	
6	**Network Security:** Network attacks, DoS and DDoS attack, Sniffing, Session hijacking, Spoofing, Phishing, Cross-site Scripting (XSS), IPSec Protocol, SSL Handshake Protocol, Firewalls, IDS Prevention and Detection.	**06**

Books Recommended:

Text Books:

1. William Stallings, “Crpyptography and Network Security Principles and Practices”, Seventh Edition, Pearson Education, 2017.
2. Behrouz A. Forouzan, Debdeep Mukhopadhyay, “Cryptography and Network Security”, Third Edition, McGraw Hill, 2015.

Reference Books

1. Atul Kahate, "Cryptography and Network Security”, Third Edition, McGrawHill, 2017.
2. Bernard Menezes, "Network Security and Cryptography", First Edition, Cengage Learning, 2010.
3. Wade Trappe, Lawrence C Washington, “Introduction to Cryptography with coding theory”, second Edition, Pearson, 2005.
4. W. Mao, “Modern Cryptography, "Theory and Practice”, First Edition, Pearson Education, 2003.
5. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, "Security in computing", Pearson, Fifth edition, 2015.

Web Links:

1. Damn Vulnerable Web Application (DVWA): http://dvwa.co.uk
2. Open Web Application Security Project: https://owasp.org
3. Web penetration testing: https://pentesterlab.com
4. Penetration Testing: https://kali.org

Suggested List of Laboratory Experiments:

S No	Title of the Experiments
1.	Create a network using CISCO packet tracer.
2.	Connect the computers in Local Area Network.
3.	Implement Playfair Cipher with key entered by user.
4.	Implement polyalphabetic Cipher
5.	Implement Simple and Advanced Columner Transposition technique
6.	Implement Simplified DES
7.	Implement Simple RSA Algorithm with small numbers.
8.	Implement Diffie-Hellman Key Exchange
9.	Implement DoS and DDoS attack using Hping.
10.	Implement phishing attack using HTTrack Website Cloning.

11.	Implement static code analysis using Flawfinder Python Distribution.
12.	Implement packet sniffing using Wireshark and TCP Dump.
13.	Implement cross site request forgery in a controlled virtual environment using DVWA Web Server.
14.	Implement firewalls using IP tables.
15.	Implement Network Intrusion Detection System (NIDS).
16.	Implement Host based Intrusion Detection System (HIDS).

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, 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 **DJ19DSL503** 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

Program: Third Year B.Tech. in Computer Science and Engineering (Data Science)										**Semester: V**
Course: JAVA and Scala Laboratory										**Course Code: DJ19DSL504**
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**			
--	**4**	--	**2**	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Assignment/ Mini project / presentation/ Journal**	**Total Term work**	**100**
				--	--	**50**	**25**	**25**	**50**	

Pre-requisite: Programming Fundamentals

Course Objectives:

1. To learn JAVA and Scala programming concepts.
2. To understand the difference in Object oriented programming and Functional programming.

Outcomes: Students will be able to

1. Implement Java and Scala program to provide solution for a given Problem.
2. Select suitable programming language depending on the scalability of an application.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Object Oriented Programming** 1.1. Features of Java, JVM 1.2. Basic Constructs/Notions: Constants, variables and data types, Operators and Expressions, Revision of Branching and looping 1.3. Implementation of First Java Program	**02**
2	**Classes, Object and Packages** 2.1 Implement a Java program to demonstrate Class, Object, Methods 2.2 Implement Java program to demonstrate Constructor, Static members and methods 2.3 Implement a Java program to solve a given problem using object-oriented concept. 2.4 Implement a Java program to demonstrate the use of build in packages.	**04**
3	**Array, String and Vector** 3.1 Implement a Java program using 1 D and 2D Array 3.2 Implement Java program to demonstrate Strings and String Buffer class 3.3 Implement Java program to demonstrate use of Wrapper classes 3.4 Implement Java program on Vector	**06**

4	**Inheritance and Interface** 4.1 Implement Java program to demonstrate types of inheritance, super keyword 4.2 Implement Java program on abstract class and Abstract Method. 4.3 Implement Java program on interface demonstrating concept of multiple inheritance. 4.4 Implement Java program on dynamic method dispatch using base class and interface reference.	**04**
5	**Exception Handling and Multithreading** 5.1 Implement Java program to demonstrate try, catch, throw, throws and finally. Also, implement user defined exception. 5.2 Program to demonstrate concept of Multithreading 5.3 Implement Java program to demonstrate the concepts of Thread Synchronization.	**04**
6	**GUI programming in JAVA** 6.1 Implement a JAVA program to create GUI applications with event handling using SWING (Swing components, Containers, JLabel, JButton, JCheckBox, JRadio Buttons, JTextField etc) 6.2 Implement a JAVA program to create application using SPRING Framework. 6.3 Implement a JAVA program to demonstrate Database connectivity using JDBC.	**06**
7	**Functional Programming Basics Using Sala** 7.1 Introduction to Scala: -Characteristics of Functional Programming, Benefits of Scala, Evolution of Scala 7.2 Installation of Scala, Run REPL (Read, Evaluate, Print Loop) in Scala 7.3 Scala Using Eclipse	**02**
8	**Scala Programming Basics: -** 8.1 Implement a program to demonstrate Scala programming basic Variable, Data types, Special escape Sequence, String interpolation, Type Conversion, Scope of Variable 8.2 Implement a program in SCALA to demonstrate Operators, Precedence Rules, Mathematical Functions 8.3 Implement program to demonstrate Conditional Statements and Loops	**04**
9	**Scala Collection** 9.1 Implement Program to demonstrate Array, List and Sets in Scala 9.2 Implement Program to demonstrate Tuple, Maps, iterator and String in Scala	**04**
10	**Scala Functions** 10.1 Implement Scala programs to demonstrate Functions Without Any Argument and Return Type, Function to accept another Function as an Argument, Function accepting list and an anonymous Function as argument 10.2 Implement programs to demonstrate In-built Functions in Scala. 10.3 Implement Scala programs to demonstrate Call by value and call by name	**04**
11	**Scala Class object and Inheritance** 11.1 Implement Scala programs to demonstrate class and objects 11.2 Implement Scala programs to demonstrate inheritance	**04**

12	**Traits and Packages and Pattern Matching in Scala** 12.1 Implement program to demonstrate Traits and packages in Scala 12.2 Implement program to demonstrate multiple Inheritance in Scala 12.3 Implement program to demonstrate Pattern matching in Scala	**04**
13	**Exception Handling and File Handling in Scala** 13.1 Implement program to demonstrate Exception Handling in Scala 13.2 Implement program to demonstrate File Handling in Scala	**04**

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

Books Recommended:

Text books:

1. Herbert Schildt, "JAVA: The Complete Reference", Ninth Edition, Oracle Press, 2014.
2. Partha Sarathi Bishnu," Functional Programming using Scala," 2012

Reference Books:

1. Dean Wampler and Alex Payne, "Programming Scala," O'Reilly, 2014.
2. Ivor Horton, "Beginning JAVA", Wiley India, 2011.
3. Deiteland Deitel, "Java: How to Program", 8/e,PHI, 2010.
4. "JAVA Programming", Black Book, Dreamtech Press.
5. "Learn to Master Java programming", Staredusolutions
6. Sachin Malhotra and Saurabh Chaudhary, "Programming in Java", Oxford University Press, 2010.

Web Links:

1. Virtual Lab: https://java-iitd.vlabs.ac.in
2. Virtual Lab: http://vlabs.iitb.ac.in/vlabs-dev/labs/java-iitd/experiments/java-intro-iitd/index.html
3. NPTEL video course link: Programming in Java: https://onlinecou rses.nptel.ac.in/noc22_cs47/preview

Evaluation Scheme:

Practical and Oral (A):

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

1. Implementation: 25 Marks
2. Oral: 25 Marks

Total: 50 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): 30 Marks
2. Quiz: 20 Marks

Marks Total: 50 Marks

Prepared by Checked by Head of the Department Principal

DEPARTMENT ELECTIVES

Syllabus for First Year Engineering (All Branches) - Semester II (Autonomous)
(Academic Year 2019-2020)

Program: Third Year B.Tech. in Computer Science and Engineering (Data Science)	**Semester: V**
Course: Distributed Computing	**Course Code: DJ19DSC5011**
Course: Distributed Computing Laboratory	**Course Code: DJ19DSL5011**

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

Pre-requisite: Operating Systems

Course objectives: The objective of this course is to introduce the fundamentals of distributed computing that includes system architecture, programming model, design, and implementation and performance analysis of these systems.

Course outcomes: On successful completion of course, learner will be able to:

1. Demonstrate Interprocess Communication and Synchronization in a Distributed System.
2. Apply appropriate Resource, Process management, File and Memory technique in a given Distributed Environment for efficient processing.
3. Apply suitable methods to improve data availability in a system.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction:** Distributed Computing Models, Issues in Designing Distributed Systems, Network communication: LAN and WAN technologies, Protocols for Network Systems, Asynchronous Transfer Mode.	**04**
2	**Communication:** Interprocess Communication: Message Passing, Group Communication, API for Internet Protocols; Remote Communication: Middleware, Remote Procedural Call (RPC) Basics, RPC Implementation, RPC Communication, Exception Handling and Security, RPC in Heterogeneous environment, Failure Handling, RPC Optimization.	**08**
3	**Synchronization:** Clock Synchronization, Logical Clocks, Global State, Mutual Exclusion: Centralized, Decentralized, Distributed and Token Ring Algorithms, Election Algorithms: Ring and Bully election algorithms, Deadlocks in Distributed Systems.	**08**
4	**Resource and Process Management:** Desirable features of a global scheduling algorithm, Task Assignment Approach, Load Balancing Approach, Load Sharing	**06**

	Approach, Functions of Distributed Process Management, Desirable features of a process migration mechanism, Process migrations and Threads.	
5.	**Consistency, Replication and Fault Tolerance:** Introduction to Replication and Consistency, Data-Centric (Continuous Consistency, Consistent Ordering of Operation) and Client-Centric (Eventual Consistency, Monotonic Read, Monotonic Write, Read your Writes, Writes follow Reads); Consistency Models, Replica Management; Fault Tolerance: Introduction, Process resilience, Reliable client-server and group communication, Recovery	**08**
6.	**Distributed Shared Memory (DSM) and Distributed File System (DFS):** DSM Architecture, Types of DSM, Advantages of DSM, Design Issues in DSM systems, Issues in Implementing DSM systems; Introduction to DFS, DFS Designs, DFS Implementation, File Caching and Replication in DFS.	**08**

Books Recommended:

Text Books:

1. Andrew S. Tanenbaum and Maarten Van Steen, ―Distributed Systems: Principles and Paradigms, 2nd edition,Pearson Education, 2017.
2. Sunita Mahajan and Seema Shah, "Distributed Computing", Oxford University Press, 2013.

Reference Books:

1. S. Tanenbaum and M. V. Steen, "Distributed Systems: Principles and Paradigms", Second Edition, PrenticeHall, 2006.
2. M. L. Liu, ―Distributed Computing Principles and Applications‖, Pearson Addison Wesley, 2019.
3. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems: Concepts and Design", 5th Edition,Pearson Education, 2011.

Web Links:

1. NPTEL Course: Distributed Computing Systems: https://nptel.ac.in/courses/106106107
2. NPTEL Course: Distributed Systems: https://nptel.ac.in/courses/106106168

Suggested List of Experiments:

Sr. No.	Title of Experiments
1	Implement Client/server using RPC/RMI.
2	Implementation of multi tread application
3	Implement Inter-process communication
4	Implement Group Communication
5	Implement Load Balancing Algorithm.
6	Implement Election Algorithm.
7	Implement Clock Synchronization algorithms.
8	Implement Mutual Exclusion Algorithm.
9	Implement Deadlock management in Distributed systems
10	Implement Distributed File System

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 internalchoice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

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

Continuous Assessment (B):

Theory:

1. 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 **DJ19DSC5011** with minimum 10 experiments to be incorporated along withminimum 2 assignments.

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

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

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

Syllabus for First Year Engineering (All Branches) - Semester II (Autonomous)
(Academic Year 2019-2020)

Program: Third Year B.Tech. in Computer Science and Engineering (Data Science)	**Semester: V**
Course: Time Series Analysis	**Course Code: DJ19DSC5012**
Course: Time Series Analysis Laboratory	**Course Code: DJ19DSL5012**

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

Pre-requisite: Probability, Statistics and Linear Models.

Objectives: Learn basic analysis of time series data; concepts in time series regression; auto-regressive and model averaging models; learn basic concepts of spectral analysis and space-time models.

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

1. Interpret a correlogram and a sample spectrum
2. Apply appropriate model for a time series dataset.
3. Compute forecasts for a variety of linear and non-linear methods and models.

Detailed Syllabus: (unit wise)

Unit	**Description**	**Duration**
1	**Introduction:** Types of forecasting methods, Types of Time Series, simple descriptive techniques, trends in time series (Parametric trends, differencing, non parametric methods, noise), seasonality, Stationary stochastic processes, the correlogram. **Stationary Time Series:** Formal definition of a time series, the sample mean and its standard error, Stationary processes: types of stationarity, statistical inference of time series.	**06**
2	**Linear Time Series:** Motivation, Linear time series and moving average models, The AR model, simulating from an autoregressive process, The ARMA model, The ARIMA model, Unit roots, integrated and non-invertible processes, Box – Jenkins Model Selection, Seasonality, The SARIMA model.	**06**
3	**Prediction:** Using prediction in estimating, forecasting for autoregressive processes, forecasting for AR, forecasting for general time series using infinite past, One-step ahead predictors based on the finite past: Levinson -Durbin algorithm; Forecasting for ARMA processes, The Kalman filter;	**08**

4	**Models with Trend:** Removing trend, Unit Root and Regression Residuals, The Monte Carlo Method, Dickey-Fuller tests. **Multiequation Time Series Models**: Intervention Analysis, ADLs and Transfer Functions, Introduction to VAR Analysis.	**10**
5	**Multivariate Time Series:** Background: Sequences and Functions, Convolution, Spectral Representations and mean squared errors; Multivariate time series regression: Conditional independence, Partial correlation and coherency between time series.	**06**
6	**Non Linear Time series:** The ARCH model: Feature of an ARCH, Existence of a strictly stationary solution, The GARCH model: Existence of stationary solution of a GARCH(1,1) and Bilinear models	**06**

Books Recommended:

Text Books

1. Walter Enders," Applied Econometric Time Series," Fourth Edition, Wiley, 2014.
2. B. V. Vishwas and Ashish Patel, "Hands-on Time Series Analysis with Python," First Edition, Apress, 2020

Reference Books

1. Chris Chatfield, "Time- Series Forecasting," First Edition, Chapman & Hall/CRC, 2001.
2. Douglas C. Montgomery, Cheryl L. Jennings and Nurat Kulahci, "Introduction to Time Series Analysis and Forecasting," Second Edition, Wiley, 2015.
3. Aileen Nielsen, "Practical Time Series Analysis," O'Reilly, 2019.
4. James D Hamilton, "Time Series Analysis," Princeton University Press, 1994.
5. Robert H. Shumway and David S. Stoffer, "Time Series Analysis and Its Applications," Springer, 2000.

Web Links:

1. A course on Time Series Analysis. https://web.stat.tamu.edu/~suhasini/teaching673/time_series.pdf
2. A comprehensive guide to Time Series Analysis. https://www.analyticsvidhya.com/blog/2021/10/a-comprehensive-guide-to-time-series-analysis/
3. The Complete Guide to Time Series Analysis and Forecasting. https://towardsdatascience.com/the-complete-guide-to-time-series-analysis-and-forecasting-70d476bfe775

Suggested List of Laboratory Experiments:

S No	Name of Experiment
1.	Time Series Characteristics: Time Series Data, Cross-Section Data, Panel data/ Longitudinal data
2.	Trends: (1) Detecting trends using Hodrick -Prescott Filter. (2) Detrending a Time Series
3.	Seasonality: (1) Multiple Box Plots (2) Autocorrelation Plot (3) Deseasoning of Time-Series Data (4) Seasonal Decomposition (5) Detecting Cyclic Variations
4.	Data Wrangling and Preparation for Time Series Data
5.	Smoothing Methods: Simple exponential, Double exponential and Triple exponential.
6.	Making Data Stationary: Plots, Summary Statistics, Statistics Unit Root Tests, Augmented Dickey – Fuller Test.

7.	Autoregressive Model
8.	Moving Average Model
9.	ARMA Model
10.	ARIMA Model
11.	SARIMA Model
12.	Anomaly Detection in Time Series Data.

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 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 **DJ19DSL5012** 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 First Year Engineering (All Branches) - Semester II (Autonomous)
(Academic Year 2019-2020)

Program: Third Year B.Tech. in Computer Science and Engineering (Data Science)	**Semester: V**
Course: Digital System Design	**Course Code: DJ19DSC5013**
Course: Digital System Design Laboratory	**Course Code: DJ19DSL5013**

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: Basic Electrical & Electronics Engineering

Objectives:

1. To introduce different digital codes and their conversions.
2. To introduce methods for minimizing logical expressions.
3. To outline the formal procedure to design combinational logic circuits.
4. To introduce flip flops and outline the formal procedure to sequential circuits.
5. To illustrate concept of programmable devices

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

1. Explain different digital codes and their conversions.
2. Minimize logic expressions using various reduction techniques
3. Analyze and design combinational logic circuits
4. Design flip-flops using logic gates and use them to realize different sequential circuits
5. Classify different programmable logic devices.

Detailed Syllabus: (unit wise)

Unit	**Description**	**Duration**
1	Digital codes and binary arithmetic: Signed Binary number representation: Sign Magnitude, 1's complement, 2's complement representation and binary arithmetic's. Codes: Binary, BCD, XS-3, Gray code, ASCII, EBCDIC, Parity, Hamming, conversions	**12**
2	Minimization techniques and Logic gates: Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NOR, Implementations of Logic Functions using universal gates. Boolean postulates and laws – De-Morgan's Theorem, Boolean expression - Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS), Minimization of Boolean expressions —– Karnaugh map Minimization – Quine - Mc Cluskey method of minimization, don't care conditions	**09**

3	Design of Combinational Logic: Introduction to combinational logic, Code converter: BCD, Excess-3, Gray code, Binary Code, Half- Adder, Full Adder, Half Subtractor, Full Subtractor, Binary Adder, BCD adder, Look ahead carry generator, Multiplexers- MUX tree, Encoder, De-multiplexer & Decoders, Implementation of SOP and POS using Multiplexer & De-multiplexer/Decoder	**04**
4	Sequential Logic Design: Introduction to sequential logic, Flip- flop: SR, JK, D, T; Preset & Clear, Truth Tables and Excitation tables, Conversion, Shift Registers: SISO, SIPO, PISO, PIPO, Bi-directional, Counters: Asynchronous counter, Synchronous counter, ring counters, Johnson Counter, Modulus of the counter. State Machines: Basic design steps- State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation, Sequence detector	**09**
5	Programmable Logic Devices: Programmable logic devices: Architecture of PROM, PAL, PLA, designing combinational circuits using PLDs. General Architecture of FPGA and CPLD, introduction to Hardware Description Language	**08**

Books Recommended:

Text books:

1. John F. Wakerly, “Digital Design Principles and Practices”, Pearson Education, Fifth Edition, 2018.
2. R. P. Jain, “Modern Digital Electronics”, Tata McGraw Hill 4th Edition, 2010.
3. M. Morris Mano, “Digital Logic and computer Design”, PHI 4th Edition 2010.

Reference Books:

1. Thomas L. Floyd, “Digital Fundamentals”, Pearson Prentice Hall, Eleventh Global Edition, 2015.
2. Mandal, “Digital Electronics Principles and Applications”, McGraw Hill Education, First Edition, 2010.
3. Ronald J. Tocci, Neal Widmer, “Digital Systems Principles and Applications”, Twelfth Edition, PHI (2017)
4. Donald P Leach, Albert Paul Malvino, “Digital Principles and Applications”, Tata McGraw Hill, Eighth edition, 2015.
5. Balabanian, Carlson, “Digital Logic Design Principles”, Wiley Publication 3rd Edition, 2000.
6. Holdsworth and R. C. Woods, “Digital Logic Design”, 4thEdition, Newnes, 2002.
7. William I. Fletcher, “An Engineering Approach to Digital Design”, Tenth Edition, PHI, 2015.

Web Links:

1. Digital Electronic Circuits Lab: http://vlabs.iitkgp.ac.in/dec/#
2. Virtual Lab: https://cse15-iiith.vlabs.ac.in/List%20of%20experiments.html
3. NPTEL Course: Digital System Design: https://nptel.ac.in/courses/108106177

Suggested list of Laboratory Experiments: (Any 10 to 12)

S No	Name of Experiment
1.	Implement 8:3 octal to binary code converter using encoder IC 74148
2.	Verify different logic gates (introduce logic families CMOS and TTL and electrical and switching parameters)
3.	Simplification of Boolean functions
4.	Verify Universal gates NAND and NOR and design EXOR and EXNOR gates using Universal gates.
5.	Implement Half adder, Full adder, Half subtractor and Full subtractor circuits.
6.	To study and implement 4-bit magnitude comparator using IC 7485 and verify its truth table.
7.	Implement BCD adder using 4-bit binary adder IC-7483.
8.	Flip flops conversion JK to D, JK to T and D to T FF.

9.	Implement logic equations using Multiplexer.
10.	Design synchronous MOD N counter using IC-7490.
11.	Verify encoder and decoder operations.
12.	Implement 1:8 De-multiplexer using IC 74138.
13.	Implement the functions using 8:1 Multiplexer with the help of IC 74151
14.	Implement digital circuits to perform binary to gray and gray to binary operations.
15.	Verify different counter operations
16.	Verify the functions of Universal Shift Register IC 74194: Parallel loading, Right shift, Left shift
17.	Implement any two above experiments using HDL

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

Laboratory:

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

Continuous Assessment (B):

Theory:

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

Laboratory: (Term work)

Term Work shall consist of at least 10 practical's based on the above list. The distribution of marks for term work shall be as follows:

i Laboratory work (Performance of Experiments): 15 marks

ii Journal Documentation (Write-up, 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 First Year Engineering (All Branches) - Semester II (Autonomous)
(Academic Year 2019-2020)

Program: Second Year B.Tech. in Computer Science and Engineering (DataScience)	**Semester: V**
Course: Probabilistic Graph Models	**Course Code: DJ19DSC5014**
Course: Probabilistic Graph Models	**Course Code: DJ19DSL5014**

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 / Assignment/ Mini project / presentation/ Journal**	**Total Term work**	**50**
				25	**--**	**--**	**15**	**10**	**25**	

Pre-requisite: Machine learning, Probability

Course Objectives: The objective of this course intends to model problems using graphical models; design inference algorithms; and learn the structure of the graphical model from data.

Outcomes: Students will be able to

1. Explain the basic fundamentals of probabilistic graph theory.
2. Illustrate various principles of graph theory and algorithms.
3. Integrate core theoretical knowledge of graph theory to solve problems.

Detailed Syllabus: (unit wise)

Unit	**Description**	**Duration**
1	**Fundamentals:** Structured Probabilistic Models, Marginal and Joint Distributions, Independence and Conditional Independence. **Bayesian Networks:** Independence and Separation, Markov properties and minimalism, Examples (HMM, diagnostic system, etc.).	**06**
2	**Markov Networks:** Boltzmann machine and Ising models, Markov random field, Parameterization, Cliques and potentials, Markov Network Independencies, Factor graphs. **Gaussian Network Models and Exponential Family:** Multivariate Gaussians and Gaussian Networks, Exponential families, Entropy and Relative Entropy, Projections.	**08**

3	**Inference:** Analysis of Complexity, Variable elimination, Belief propagation (message passing) on trees, Sum- and Max-product algorithms, Clique tree.	**06**
4	**Sampling Methods:** MCMC method, Gibbs sampling Algorithm, Importance sampling, Particle filtering. Approximate inference: Loopy belief propagation, Variational inference and optimization view of inference, Mean field approach	**06**
5	**Parameter learning:** Parameterizing graphical models, Parameter estimation in fully observed Bayesian networks: (Maximum likelihood estimation, Bayesian parameter estimation, Example: HMM), Parameter estimation in fully observed Markov networks: Maximum likelihood estimation (Iterative Proportional Fitting (IPF), Generalized Iterative Scaling (GIS)), Parameter estimation in partially observed graphical models (Expectation-Maximization (EM) - Example: HMM), Learning Conditional Random Fields. **Nonparametric Learning:** Gaussian processes, Dirichlet processes, Indian Buffet processes	**12**
6	**Structure learning:** Score based approach, Chow-Liu algorithm for Bayesian networks, l1-regularized convex optimization for Markov random fields, Low-rank regularized learning of latent variable models.	**06**

Books Recommended:

Text Books:

1. Koller, D. and Friedman, N. "Probabilistic Graphical Models: Principles and Techniques," MIT Press, 2009.

Reference Books:

1. Jensen, F. V. and Nielsen, T. D. "Bayesian Networks and Decision Graphs. Information Science and Statistics," 2nd edition, Springer, 2002.
2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective," 4th Printing. MIT Press, 2013.
3. Barber, D. "Bayesian Reasoning and Machine Learning," 1st edition, Cambridge University Press, 2011.
4. Bishop, C. M. "Pattern Recognition and Machine Learning (Information Science and Statistics)". 2nd printing, Springer, 2011.
5. Wainwright, M. and Jordan, M. "Graphical Models, Exponential Families, and Variational Inference," Foundations and Trends in Machine Learning, 2008.

Suggested List of Laboratory Experiments:

Sr. No	Title of the Experiments
1	Implement Discrete Bayesian Networks.
2	Implementation of Alarm Bayesian Network.
3	Implementation of Linear Gaussian Bayesian Networks (GBNs).
4	Implementation of Monty Hall Problem using Bayesian Network.
5	Implementation of Exact inference in Bayesian Networks.
6	Implementation of Inference in Discrete Bayesian Network.
7	Implementation of Causal Inference.
8	Implementation of Parameter Learning in Discrete Bayesian Networks
9	Implementation of Learning using Chow-Liu Algorithm.

10	Implementation of learning Tree-augmented Naive Bayes (TAN).

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:

3. Question paper based on the entire syllabus, summing up to 75 marks.
4. 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 **DJ19DSL5014** 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

COMMON TO ALL BRANCHES

Syllabus for First Year Engineering (All Branches) - Semester II (Autonomous)
(Academic Year 2019-2020)

Program: Third Year B.Tech. in Computer Science and Engineering (Data Science)	**Semester: V**
Course: Environmental Studies	**Course Code: DECL505**

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**			
1	**--**	**--**	**--**	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**	**Total Term work**	**50**
				--	--	--	--	---	**50**	

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

Detailed Syllabus: (unit wise)

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

Books Recommended:

Text books:

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

A Sustainable Approach", Elsevier, 2015.

Reference Books:

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

Prepared by Checked by Head of the Department Principal

Syllabus for First Year Engineering (All Branches) - Semester II (Autonomous)
(Academic Year 2019-2020)

<table>
<tr><td colspan="8">Program: Third Year B.Tech. in Computer Science and Engineering (Data Science)</td><td colspan="3">Semester: V</td></tr>
<tr><td colspan="8">Course: Innovative Product Development - III</td><td colspan="3">Course Code: DJ19CEL506</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>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><td></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="3">Term work</td><td rowspan="2">Total Term work</td><td rowspan="2">25</td></tr>
<tr><td>-</td><td>2</td><td>--</td><td>1</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td>Tutorial/ Mini project/ presentation/ Journal</td></tr>
<tr><td colspan="4"></td><td>--</td><td>--</td><td>--</td><td>15</td><td>10</td><td>25</td><td></td></tr>
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Objectives:

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

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 conceptualizing a product, especially while working in a team.
3. Use standard norms of engineering concepts/practices in the design and development of an innovative product.
4. Draw proper inferences through theoretical/ experimental/simulations and analyze 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:

1. 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).
2. 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.

3. 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.
4. Students shall convert the best design solution into a working model, using various components drawn from their domain as well as related interdisciplinary areas.
5. 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.
6. 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.
7. 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.
8. 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 4semesters,i.e. during the semesters III to VI.

Guidelines for Assessment of the work:

1. 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.
2. In the continuous assessment, focus shall also be on each individual student's contribution to the team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.
3. Distribution of marks individually for the both reviews as well as for the first review during the subsequent semester shall be as given below:
   A. Marks awarded by the supervisor based on log-book : 20
   B. Marks awarded by review committee : 20
   C. Quality of the write-up : 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 finalization of the product selected.
- Second shall be on finalization of the proposed design of the product.

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 V reviews may be based on relevant points listed above, as applicable.

Guidelines for Assessment of Semester Reviews:

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

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