Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and detailed syllabus (DJS22)

Third Year B.Tech

in

Artificial Intelligence (AI) and Data Science

(Semester V)

Proposed Scheme for Third Year Undergraduate Program in Artificial Intelligence (AI) and Data Science: Semester V (Autonomous)

Sr No	Course Code	Course	Teaching Scheme(hrs)				Continuous Assessment (A) (marks)			Semester End Assessment (B) (marks)					Aggregate (A+B)	Total Credits
			Th	P	T	Credits	Th	T/W	Total CA (A)	Th	O	P	O &P	Total SEA (B)		
1	DJS22ADC501	Image Processing	3	--	--	3	35	--	35	65	--	--	--	65	100	4
	DJS22ADL501	Image Processing Laboratory	--	2	--	1	--	25	25	--	25	--	--	25	50	
2	DJS22ADC502	Machine Learning	3	--	--	3	35	--	35	65	--	--	--	65	100	4
	DJS22ADL502	Machine Learning Laboratory	--	2	--	1	--	25	25	--	--	--	25	25	50	
3	DJS22ADC503	Natural Language Processing	3	--	--	3	35	--	35	65	--	--	--	65	100	4
	DJS22ADL503	Natural Language Processing Laboratory	--	2	--	1	--	25	25	--	25	--	--	25	50	
4	DJS22ADL504	Computer Networks and Cloud Computing Laboratory	--	4	--	2	--	25	25	--	--	--	25	25	50	2
5 @	DJS22ADC5011	IoT and Edge Computing	3	--	--	3	35	--	35	65	--	--	--	65	100	4
	DJS22ADL5011	IoT and Edge Computing Laboratory	--	2	--	1	--	25	25	--	25	--	--	25	50	
	DJS22ADC5012	Nature Inspired Computing	3	--	--	3	35	--	35	65	--	--	--	65	100	
	DJS22ADL5012	Nature Inspired Computing Laboratory	--	2	--	1	--	25	25	--	25	--	--	25	50	
	DJS22ADC5013	Recommendation Systems	3	--	--	3	35	--	35	65	--	--	--	65	100	
	DJS22ADL5013	Recommendation Systems Laboratory	--	2	--	1	--	25	25	--	25	--	--	25	50	
	DJS22ADC5014	DevOps	3	--	--	3	35	--	35	65	--	--	--	65	100	
	DJS22ADL5014	DevOps Laboratory	--	2	--	1	--	25	25	--	25	--	--	25	50	
6	DJS22A3	Environmental Studies	1	--	--	--	--	--	--	--	--	--	--	--	--	--
7	DJS22ILLL1	Innovative Product Development III	--	2	--	1	--	25	25	--	--	--	25	25	50	1
		Total	13	14	0	19	140	150	290	260	75	0	75	410	700	19

Th	Theory	T/W	Termwork
P	Practical	O	Oral
T	Tuturial		

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

Continuous Assessment (A):

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

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

Semester End Assessment (B):

Course	Assessment Tools	Marks	Time (hrs.)
Theory / * Computer based	Written paper based on the entire syllabus.	65	3
	* Computer based assessment in the college premises.		
Oral	Questions based on the entire syllabus.	25	as applicable
Practical	Performance of the practical assigned during the examination and the output / results obtained.	25	2
Oral & Practical	Project based courses - Performance of the practical assigned during the examination and the output / results obtained. Based on the practical performed during the examination and on the entire syllabus.	As per the scheme	2

Prepared by Checked by Head of the Department Vice Principal Principal

Program: Third Year B.Tech. in Artificial Intelligence(AI) and Data Science									**Semester : V**
Course: Image Processing									**Course Code: DJS22ADC501**
Course : Image Processing Laboratory									**Course Code: DJS22ADL501**
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**	**Total**
				65			**20**	**15**	**35**
				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**

100 | **50**

Prerequisite:

1. Basics of Mathematics
2. Different Transforms

Objectives:

1. To learn the fundamental concepts of Digital Image Processing.
2. To understand basic image enhancement
3. To learn Image segmentation techniques.
4. To illustrate Image Transform calculations mathematically and develop algorithm

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

1. Illustrate & make use of the fundamental concepts and basic elements of digital image processing.
2. Apply image enhancement in spatial domain, frequency domain and using histogram modelling.
3. Apply different image segmentation and representation techniques on images.
4. Examine different morphological operations used in binary image processing.
5. Analyse image in frequency domain through different transforms.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Digital Image Processing Fundamentals:** Introduction: Digital Image Representation, Fundamental Steps in Image Processing, Elements of a Digital Image Processing System. Digital Image Fundamentals: Sampling and Quantization, Some Basic Relationships between Pixels, Image File Formats, Image Types.	4

2	**Image Enhancement**: **Spatial domain** - Point processing techniques (Digital Negative, Contrast Stretching, Thresholding, Bit Plane Slicing, Power Law Transformation, Dynamic Range Compression), Histogram Modelling (Histogram Stretching & Histogram Equalization), Neighborhood processing –Noise, Smoothing (Low Pass Averaging Filter, Low Pass Median Filter) & Sharpening Filters (High Pass Filtering & High Boost Filtering).**Image Enhancement**: **Frequency domain-** Fourier Transform,1D-DFT, Frequency domain techniques - 2D-DFT, Low pass Filter (Ideal, Butterworth, Gaussian), High pass Filter (Ideal, Butterworth, Gaussian).	11
3	**Image Segmentation**: Connectivity of Pixels, Detection of discontinuities(Point, Line, Edge) ,Detection of Edges (Computing Gradients, 1st order Derivative Filters,2nd order Derivative Filters, Laplacian of Gaussian), Edge linking(Local Processing & Hough transform), Region-based segmentation-Region Growing, Region Splitting, Region Merging, Region Split & Merge	11
4	**Image Transforms**: DFT, FFT, DCT, DST, Hadamard Transform, Fast Hadamard Transform ,Walsh Transform, Haar Transform, Basis functions and basis images	7
5	**Morphology, Representation and Description**: Dilation, Erosion, Open, Close, Hit-or-miss, Boundary extraction, Region filling, Thinning and thickening, Feature Extraction (Chain Codes).Image Restoration- Mean Filters, Order Statistic Filters	6
	Total	39

List of Laboratory Experiments: (DJS22ADL501)

Sr. No.	Suggested Experiments
1	To implement Point Processing – Digital Negative, Contrast Stretching
2	To implement Point Processing – Thresholding, Grey level Slicing (Intensity Slicing)
3	To implement Point Processing – Power law transformation, Dynamic Range Compression
4	To implement Averaging and Median filtering technique on given noisy images (Spatial Domain)
5	To implement HPF & HBF
6	To perform Histogram Stretching
7	To perform Histogram Equalization
8	To compute DFT of an image and display it as an image
9	To implement Frequency Domain Filtering Techniques (Low pass -Ideal, Butterworth and Gaussian Filter
10	To implement Frequency Domain Filtering Techniques (High Pass- Ideal, Butterworth and Gaussian Filte
11	To implement Sobel & Prewitt operators
12	To implement Gradient operators (2nd Order Derivative Filters)
13	To perform Dilation Erosion operations on an image.
14	To perform Opening Closing operations on an image.
15	To implement Different Transforms on an Image
16	Mini Project
17	Research /Review Article

Minimum eight experiments from the above-suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. Digital Image Processing, Gonzalez and Woods- Pearson Education.
2. Fundamentals of Digital Image Processing, A.K. Jain –P.H.I.
3. Digital Image Processing and Analysis, Chanda Majumder-Prentice Hall India.

Reference Books:

1. Digital Image Processing and Computer Vision, Sonka, Hlavac, Boyle-Cengage learning.
2. Digital Image Processing, William Pratt- John Wiley.

Online Resources:

1. Swayam Digital Image Processing Course by Prof. Prabir Kr. Biswas , IIT Kharagpur
2. Coursera Fundamentals of Digital Image and Video Processing, Northwestern

Prepared by Checked by Head of the Department Vice Principal Principal

Program: Third Year B.Tech. in Artificial Intelligence (AI) and Data Science	**Semester : V**
Course: Machine Learning	**Course Code: DJS22ADC502**
Course : Machine Learning Laboratory	**Course Code: DJS22ADL502**

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**	**Total**	
				65			**20**	**15**	**35**	**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**	

Prerequisite: Knowledge of basic probability and statistics, Data Mining and Analytics concepts

Course Objectives:

1. To understand key machine learning concepts: hypothesis formation, bias-variance trade-off, and model evaluation metrics.
2. To master regression, classification, and clustering techniques.
3. To apply machine learning algorithms to real-world datasets effectively.

Course Outcome: By the end of the course, students should be able to:

1. Analyse model performance using evaluation metrics.
2. Implement and tune regression and classification algorithms.
3. Apply knowledge of Bayesian learning principles.
4. Apply clustering and dimensionality reduction techniques.
5. Understand the fundamentals of Neural Networks.

Detailed Syllabus: (unit wise)

Unit	**Description**	**Duration**
1	Hypothesis and Inductive Bias, Bias-Variance Trade-off, Performance measures, Data Validation. **Evaluation & Selection**: Metrics for Evaluating Classifier Performance, Holdout Method and Random Subsampling, Cross Validation, Bootstrap, Model Selection Using Statistical Tests of Significance, Comparing Classifiers Based on Cost–Benefit and ROC Curves.	5
2	**Regression:** Linear Regression, Least Minimum Slope (LMS) algorithm, Gradient Descent, Lasso and Ridge Regression. Polynomial Regression. Logistic Regression, Maximum Likelihood Function. **Classification:** Introduction to decision tree, Learning Decision tree using ID3 and Gini index; CART, Overfitting. Ensemble methods: Bagging (Random Forest) and Boosting	8

	(XG Boost).	
3	**Bayesian Learning:** Bayesian Learning, Naïve Bayes, Bayesian Network: Representation in Bayesian, Belief Network, Inference in Bayesian Network, Applications of Bayesian Network. Classification Model	8
4	I**ntroduction to Support Vector Machine:** Support Vectors, Kernels: Linear, Polynomial and Radial Basis Function (RBF) Kernel	5
5	**Clustering:** Cluster Analysis and Requirements of Cluster Analysis Partitioning Methods: k-Means, k-Medoids Hierarchical Methods: Agglomerative, Divisive. Dimensionality Reduction: Dimensionality Reduction Techniques: Principal Component Analysis	8
6	**Introduction to Neural Networks and Deep Learning:** Deep Learning applications, Association of biological neuron with artificial network, activation functions, weights, bias, threshold, learning rate, momentum factor **McCulloch Pitts Neuron**: Theory and architecture; linear separability; Hebb Network: Theory and algorithm, ANN architectures. Hyper-parameter tuning and batch normalization, Machine Learning vs Deep Learning.	5
	Total	39

Machine Learning Laboratory (DJS22ADL502**)**	
List of Laboratory Experiments	
Sr. No	**Suggested Experiments**
1	Perform Linear Regression. a. Perform data cleaning b. EDA c. Data transformation d. Model Training e. Performance evaluation
2	Perform Logistic Regression. a. Perform data cleaning b. EDA c. Data transformation d. Model Training e. Performance evaluation
3	Perform Decision Tree using GINI. a. Data cleaning b. EDA c. Data transformation d. Model Training, Visualize Decision Tree e. Performance evaluation
4	Perform CART decision tree algorithm. a. Data cleaning b. EDA c. Data transformation d. Model Training, Visualize Decision Tree e. Performance evaluation
5	Perform Ensemble methods a. Data cleaning b. EDA c. Data transformation d. Model Training e. Performance evaluation
6	Perform Bayesian Classification a. Data cleaning

	b. EDA c. Data transformation d. Model Training e. Performance evaluation
7	Compare performance of classification algorithms. a. Model Training b. Performance evaluation c. Comparision of performance of different classification algorithms
8	Perform Support Vector Machine. a. Data cleaning b. EDA c. Data transformation d. Dimensionality reduction
9	Perform K-means/ K-Medoids clustering. a. Data cleaning b. EDA c. Data transformation d. Clustering
10	Study a machine learning patent
11	Mini project based on any machine learning application

Minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. Practical Statistics for Data Scientists, 2edition by Peter Bruce, Andrew Bruce, Peter Gedeck, O′Reilly Publisher, 2020.
2. Experimental Design and Analysis by Howard J. Seltman, July 11, 2018
3. Tom Mittchell ―Machine Learning McGraw Hill,2017.

Reference Books:

1. Data Mining for Business Analytics, (An Indian Adaptation): Concepts, Techniques and Applications in Python, Cambridge University Press, ISBN NO. 978-1108727747, 2019.
2. Andreas C. Müller and Sarah Guido- Introduction to Machine Learning with Python: A Guide for Data Scientists, O'reilly,2016
3. Stephen Marsland, ―Machine Learning an Algorithmic Perspective CRC Press, 2015
4. Han Kamber, ―Data Mining Concepts & Techniques, Morgann Kaufmann Publishers, 2012.
5. Kevin P. Murphy, Machine Learning ― A Probabilistic Perspective, 2012.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc21_cs06/preview
2. https://www.datacamp.com/tutorial/tableau-tutorial-for-beginners
3. https://www.kaggle.com/code/ekami66/detailed-exploratory-data-analysis-with-python

Prepared by Checked by Head of the Department Vice Principal Principal

Program: Third Year B.Tech. in Artificial Intelligence (AI) and Data Science	**Semester : V**
Course: Natural Language Processing	**Course Code: DJS22ADC503**
Course : Natural Language Processing Laboratory	**Course Code: DJS22ADL503**

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**	**Total**	
				65			**20**	**15**	**35**	**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**	

Prerequisite: Python Programming, Probability Mathematics

Objectives:

1. To introduce the fundamental concepts and techniques of Natural Language Processing for analyzing words based on Morphology and CORPUS.
2. To examine the NLP models and interpret algorithms for classification of NLP sentences by using both the traditional, symbolic and the more recent statistical approach.
3. To get acquainted with the algorithmic description of the main language levels that includes morphology, syntax, semantics, and pragmatics for information retrieval and machine translation applications.

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

1. Understand the Principles and Process of Natural Languages and real-world applications.
2. Demonstrate understanding of state-of-the-art algorithms and techniques for text-based processing of natural language with respect to morphology.
3. Perform POS tagging for a given natural language and select a suitable language modelling technique based on the structure of the language.
4. Check the syntactic and semantic correctness of sentences using grammars and labelling.

Detailed Syllabus: (unit wise)

Unit	**Description**	**Duration**
1	**Introduction to Natural Language Processing** Origin & History of NLP, Language, Knowledge, and Grammar in language processing, Stages in NLP, Ambiguities and its types in English and Indian Regional Languages; Applications of NLP- Machine Translation, Information Retrieval, Question Answering System, Sentiment Analysis, Text Categorization, Text Summarization, Named Entity Recognition.	4

2	**Computational tools for text analysis** Basic Terms: Tokenization, Stemming, Lemmatization, Natural Language Toolkit (NLTK): Corpora and other data resources, Uses of corpora: Lexicography, Grammar and syntax, Stylistics, Training and evaluation. Basic corpus analysis: Frequency distribution building and analyzing a corpus. Tokenization in the NLTK, Tokenizing text	6
3	**Word Level Analysis (statistical language model)** Inflectional Morphology, Derivational Morphology, Regular expression with types, Morphological Models: finite state morphology, Morphological parsing with FST (Finite State Transducer), Lexicon free FST Porter Stemmer algorithm, Grams and its variation: Bigram, Trigram, Simple (Unsmoothed) N-grams; N-gram Sensitivity to the Training Corpus, Evaluating N-grams: Perplexity, smoothing: Laplace Smoothing, Good-Turing Discounting	9
4	**Syntax analysis** Part-Of-Speech tagging (POS), Tag set for English (Upenn Treebank), Difficulties /Challenges in POS tagging , Rule-based, Stochastic and Transformation-based tagging, Generative Model: Hidden Markov Model (HMM Viterbi) for POS tagging; Issues in HMM POS tagging, Discriminative Model: Maximum Entropy model, Conditional random Field (CRF), CYK.	7
5	**Semantic Analysis** Lexical Semantics; Corpus study; Study of Various language dictionaries like WorldNet, Babelnet. Attachment for fragment of English, Relations among lexemes & their senses – Homonymy, Polysemy, Synonymy, Hyponymy, Semantic Ambiguity, Word Sense Disambiguation (WSD), Knowledge based approach (Lesk's Algorithm), Supervised (Naïve Bayes, Decision List).	8
6	**Pragmatic & Discourse Processing** Discourse: Reference Resolution, Reference Phenomena, Syntactic & Semantic constraint on coherence, Anaphora Resolution using Hobbs and Centering Algorithm, Discourse segmentation, Co-reference resolution.	5
	Total	39

List of Laboratory Experiments: (DJS22ADL503)

Sr.No.	Suggested Experiment List
1	Preprocessing steps in NLP: Tokenization, stop word Removal, Lemmatization, stemming using NLTK and SPACY
2	Implement Named Entity Recognition for any given input text .
3	Perform morphological analysis and word generation for any given text
4	Implement Chunking for the given input text.
5	Build a POS tagger using HMM
6	Similarity Detection in NLP
7	Implement N-Gram model for the given text input.
8	Generate word cloud using Python
9	Any application of NLP : Spell Check, Autocorrect, plagiarism detection, sentiment analysis, sarcasm detection or text analytics in any domain

Minimum eight experiments from the above-suggested list or any other experiment based on syllabus will be

included, which would help the learner to apply the concept learnt.

Books Recommended:

Textbooks:

1. Raymond S. T. Lee, “Natural Language Processing: A Textbook with Python Implementation”, First Edition, 2023.
2. Lewis Tunstall, Leandro von Werra, Thomas Wolf, “Natural Language Processing with Transformers”, O'Reilly , 2022.
3. Thushan Ganegedara, Andrei Lopatenko, “Natural Language Processing with TensorFlow: The definitive NLP book to implement the most sought-after machine learning models and tasks”, 2nd Edition, 2022.
4. Daniel Jurafsky, James H. and Martin, Speech and Language Processing An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Pearson, 2014.

Reference Books:

1. Masato Hagiwara, “Real-World Natural Language Processing: Practical applications with deep learning”, Mnaning,2021.
2. Ashish Bansal, “Advanced Natural Language Processing with TensorFlow 2: Build effective real-world NLP applications using NER, RNNs, seq2seq models, Transformers, and more”, Packt Publishing, 2021.

Online Resources:

1. POS Tagging Hidden Markov Models (HMM) Viterbi algorithm in NLP maths | Data Science in your pocket (medium.com)
2. Text Generation Using N-Gram Model | by Oleg Borisov | Towards Data Science
3. How to Create Beautiful Word Clouds in Python | by Tia Plagata | Towards Data Science
4. Best NLP Algorithms to get Document Similarity | by Jair Neto | Analytics Vidhya | Medium How to Chunk Text Data — A Comparative Analysis | by Solano Todeschini | Towards Data Science
5. Natural Language Processing. Title :- Morphological Analysis | by Raghvendra Zarkar | Medium

Online Courses:

1. NPTEL Course : Natural Language Processing - Course (nptel.ac.in)
2. Cousera: Natural Language Processing Specialization [4 courses] (DeepLearning.AI) | Coursera
3. Udemy: NLP - Natural Language Processing with Python | Udemy

Program: Third Year B.Tech. in Artificial Intelligence (AI) and Data Science									**Semester : V**
Course : Computer Networks and Cloud Computing Lab									**Course Code: DJS22ADL504**
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**	**Total**
				-			-	-	-
				Laboratory Examination			**Term work**		**Total Term work**
				Oral	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**	
--	4	--	2	--	--	25	15	10	25

Prerequisite:

Knowledge of programming, computer hardware/software, and operating systems.

Objective:

Learn to efficiently integrate networking and cloud computing concepts to design and implement scalable infrastructures, enabling adept management in modern IT environments.

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

1. Demonstrate data communication concepts, protocols, and utilize them in the design of networks incorporating IP addressing, subnetting, and supernetting schemes.
2. Evaluate, analyze, and investigate protocol performance variances comprehensively.
3. Acquire fundamental knowledge in cloud computing principles.
4. Gain proficiency in utilizing diverse cloud services and technologies for practical applications.

Detailed Syllabus: (Unit wise)

Unit	Description	Duration
1	**Introduction to Networking:** Introduction to computer network, network application, components of network software, Network topologies, design issues for the layers, OSI-ISO and TCP/IP reference models.	08
2	**Physical Layer and Data Link Layer** Types of Media, Design Issues: Framing, Error Control: Error Detection and Correction, Flow Control: Stop and Wait, Sliding Window **Medium Access Control Sublayer:** CSMA/CA, CSMA/CD, Wired LANS: Ethernet, Virtual LANs.	08
3	**Network Layer, Transport Layer and Application Layer** Network Layer design issues, Communication Primitives: Unicast, Multicast, Broadcast. IPv4 Addressing, Subnetting, Supernetting design problems, IPv4 Protocol, Network Address Translation, Routing algorithms: static and dynamic, ARP, RARP, ICMP, IGMP, Open loop congestion control, Closed loop congestion control, QoS parameters, Token and Leaky bucket algorithms. The Transport Service: Port Addressing, TCP and UDP, DNS, HTTP, HTTPS, SMTP, Telnet, FTP, DHCP.	14

4	**Overview of Cloud Computing, deployment models and different cloud services** Definition and essential characteristics NIST and Cloud cube model, Deployment models: Public, private, and hybrid cloud models, Advantages and use cases of each deployment model, Cloud service providers and their deployment model offerings, Factors influencing deployment model selection. Cloud services: Storage, Database, Backup and security	12
5	**Hybrid cloud technologies: Dockers, Containers and Kubernetes** Introduction to containers, Introduction to Docker, Building container images, Understanding Kubernetes architecture, Introduction to Kubernetes objects, Using basic Kubernetes objects	10
	Total	52

Suggested List of Experiments:

Sr.No.	Title of experiments (DJS22ADL504)
1	A Study of LAN topology. B.Study of various Network devices and commands.
2	Write a program to implement A) Error Detection and Correction B)Framing
3	Write a program to implement Sliding Window Protocols- Selective Repeat, Go Back N.
4	Build Class A & Class B Network using router and Implement subnetting concept.
5	Write a program to implement any one Routing Protocol.
6	Write a program to find out class of a given IP address, subnet mask & first & last IP address of that block
7	Write a program to implement Congestion Control algorithms.
8	Install and configure Network Management/ Monitoring Tools
9	Conducting a real-life case study on the implementation of cloud computing.
10	Creating and accessing virtual machines
11	Installing Nginx and hosting a public website within a virtual machine
12	Creating a local virtual machine and establishing access to it.
13	Creating and testing a load balancer using VMSS (Virtual Machine Scale Sets) service.
14	Establishing the creation and access of storage services in cloud computing.
15	Installing and utilizing Postgre DB services in cloud computing through Docker.
16	Creating and utilizing machine learning models in cloud computing

Students should be encouraged to write there program from scratch to develop better understanding of the algorithm. Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept. Minimum ten experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt

Books Recommended:

Text books:

1. Andrew S. Tanenbaum, David J. Wetherall, - Computer Networks, Pearson Education, (5e)
2. Behrouz A. Forouzan, -Data Communications and Networking‖, TMH (5e)
3. Bernard Golden, “Amazon Web Services for Dummies”, John Wiley & Sons, Inc.
4. Michael Collier, Robin Shahan, “Fundamentals of Azure, Microsoft Azure Essentials”, Microsoft Press.
5. RajkumarBuyya, Christian Vecchiola, S ThamaraiSelvi, “Mastering Cloud Computing”, Tata McGraw-

Hill Education.

Reference Books:

1. S.Keshav,- An Engineering Approach To Computer Networking, Pearson Education, (3e)
2. Marinescu, Dan C. Cloud Computing: Theory and Practice. Morgan Kaufmann, 2017.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, Mc
4. Graw Hill Education, 1st Edition, 2017.
5. Buyya, Rajkumar, Christian Vecchiola, and S. Thamarai Selvi. Mastering Cloud Computing:
6. Foundations and Applications Programming, Tata Mcgraw Hill, 1st Edition, 2017.

Program: Third Year B.Tech. in Artificial Intelligence (AI) and Data Science	**Semester : V**
Course: IoT and Edge Computing	**Course Code: DJS22ADC5011**
Course : IoT and Edge Computing Laboratory	**Course Code: DJS22ADL5011**

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**	**Total**	
				65			**20**	**15**	**35**	**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**	

Prerequisite: -

1. Basics of Digital Electronics
2. Networking, Programming basics

Course Objectives:

1. Thorough Comprehension of the IoT Ecosystem
2. Skillful Application of Edge Computing Techniques
3. Effective Implementation of Robust Security Measures for IoT and Edge Systems

Outcomes: Students will be able to:

1. Gain a comprehensive understanding of the Internet of Things (IoT) ecosystem, including key concepts, architectures, and communication protocols.
2. Examine the principles and advantages of edge computing in the context of IoT, understanding the role it plays in enhancing data processing efficiency and reducing latency.
3. Investigate and develop the unique security challenges posed by IoT devices and edge computing, including vulnerabilities, privacy concerns, and potential attack vectors.

Unit	Description	Duration
1	**Emergence of IoT, smart things and standards** Background and Vision of IoT, Definition, Key Enabling Technologies, Need of an IoT thing, Commonly used smart things, A Simplified IoT Architecture, The Core IoT Functional Stack, Comparison of M2M and IoT, IoT reference Framework, IoT Network Level, LPWAN, Wireless technologies supporting IoT applications, Network Layer Encapsulation	6
2	**Understanding the Nuts and Bolts of IoT Hardware, Software and Middleware** **Sensors and Actuators in IoT:** Introduction, perception layer, understanding commonly used sensors, Environmental sensor, mechanical sensors, Flow and fluid measuring sensors, Range and Motion capture sensors, actuators **Open Hardware in IoT:** Prototyping Boards for IoT: SoC Classification based on Functionality, Arduino Boards, Raspberry Pi, BeagleBone, Comparison of Different Hardware Platforms **IoT Middleware:** Introduction, Architecture, State-of-the-Art IoT Middleware **IoT Software Platforms:** Need and Characteristics of IoT platforms, Commercial IoT Software platforms, Open IoT Software Platforms, Choosing and IoT Platform	8
3	**Industrial Internet of Things and Industry 4.0** Introduction, Why Industrial Internet and why Now?, Industrial Internet Use-Cases: Healthcare, Oil and Gas Industry, Smart Office, IIoT Reference Architecture, Introducing Industry 4.0, Characteristics, The Value Chain, Design Principles, Building Blocks	7
4	**From the Core to the Edge** The Sensor-Cloud vs. Sensors and the Cloud, Fog: The Next-Gen Cloud, Introduction, Characteristics, Advantages, Applications, Fog Architecture: The Comprehensive Framework, Mathematical Model of the System, Application Agnostic Fog Architectures, Application-Specific Fog Architectures	7
5	**Fog Computing** The Hadoop philosophy for Fog computing, Comparing fog, edge, cloud, and mist computing, OpenFog reference architecture, EdgeX, Amazon Greengrass and Lambda, Fog topologies	5
6	**Securing IoT** Introduction, Security issues in IoT Systems and Privacy Preservation, IoT security Requirements Based on CIA Principles, Security Technologies, IoT System Security Controls, Other Security Controls for IoT Systems, Best Practices for Securing IoT Devices, Misbehavior in M2M communication.	6
	Total	39

List of Laboratory Experiments: (DJS22ADL5011)

Sr. No.	Suggested Experiments
1	To implement simple data collection using IoT devices.
2	To Understand, implement and compare communication protocols used in IoT like MQTT, CoAP.
3	To Set up edge devices and servers.
4	To develop an edge computing application for a specific industry (e.g., healthcare, manufacturing).
5	To implement analytics and decision-making processes at the edge.
6	To explore security concerns in IoT and edge computing.
7	To implement encryption and authentication for secure IoT communication.
8	To implement and IoT setup to send the data on the cloud.

9	To integrate IoT, Edge computing and Cloud computing.

Minimum eight experiments from the above-suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. Internet of Things by Surya Durbha and Jyoti Joglekar by Oxford University Press, 2021.
2. Sensors, Cloud and Fog: The Enabling Technologies for th Internet of Things by Sudip Misra, Subhadeep Sarkar and Subarna Chatterjee by CRC Press, 2019.
3. Industry 4.0: The Industrial Internet of Things by Alasdair Gilchrist by Apress, 2023.
4. IoT and Edge Computing for Architects by Perry Lea, Second edition, by Packt>, 2020.
5. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things by David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, and Jerome Henry by Cisco press, 2017.

Reference Books:

1. 21 IoT Experiments by Yashwant Kanetkar by BPB Publications, 2018.
2. Internet-of-Things (IoT) Systems: Architectures, Algorithms and Methodologies by Dimitrios Serpanos and Marilyn Wolf by Springer,2018.
3. Internet of Things: A Hands-on Approach by Arshdeep Bahga and Vijay Madisetti by Universities Press, 2014.
4. Internet of Things: Architecture and Design Principles by Raj Kamal by Mc Graw Hill, 2022.

Prepared by Checked by Head of the Department Vice Principal Principal

Program: Third Year B.Tech. in Artificial Intelligence (AI) and Data Science	**Semester : V**
Course: Nature Inspired Computing	**Course Code: DJS22ADC5012**
Course: Nature Inspired Computing Laboratory	**Course Code: DJS22ADL5012**

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**	**Total**	
				65			**20**	**15**	**35**	**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**	

Course Objectives:

1. Combines theoretical foundations with practical applications, allowing students to develop a comprehensive understanding of nature-inspired computing and its diverse range of applications.

Outcomes: Students will be able to:

1. Describe the fundamental principles of nature-inspired computing and its significance in solving complex real-world problems across various domains.
2. Demonstrate proficiency in implementing and analyzing evolutionary algorithms and swarm intelligence techniques.
3. Understand of the principles of artificial immune systems and their applications
4. Acquire knowledge of various biologically inspired computing hardware technologies

Unit	Description	Duration
1	**Module1: Introduction to Computational Problems** Computational Problems, Decision Problem, Optimization Problem, Hardness in Optimization Problems, NP class, NP-Hard, examples for NP-Hard problems, tackling NP-Hard problems, Rationale for seeking inspiration from nature.	5
2	**Module2: Evolutionary Systems** Pillars of Evolutionary Theory, The Genotype, Artificial Evolution, Genetic representations, Initial Population, Fitness Functions, Selection and Reproduction, Genetic Operators, Evolutionary Measures, Types of Evolutionary Algorithms.	6
3	**Module 3: Collective Systems** Particle Swarm Optimization Algorithm, Hybrid PSO algorithms, Ant Colony Optimization, Artificial Bee Colony, Firefly Algorithm, Simulation exercise: Implementing ant colony optimization for the traveling salesman problem.	5
4	**Module 4: Behavioral systems** Behavior in Cognitive Science, Behavior in Artificial Intelligence, Examination of the components and subsystems that comprise behavioral systems, such as sensory processing, motor control, decision-making, and learning. Overview of neural mechanisms underlying behavior, including brain regions, neurotransmitters, and neural circuits involved in various behavioral processes. Evolution and Neural Development in Behavioral Systems.	10
5	**Module5: Immuno Computing** Introduction- Immune System, Physiology and main components, Immune Network Theory, Danger Theory, Evaluation Interaction- Immune Algorithms, Bone Marrow Models, Forest's Algorithm, Artificial Immune Networks. Case study analysis: Applications of artificial immune systems in cybersecurity. Design and implementation of a simple anomaly detection system inspired by immunocomputing.	8
6	**Module 6: Biologically Inspired Computing Hardware** Overview of Memristors and neuromorphic computing, DNA computing and molecular algorithms, Quantum-inspired computing.	5
	Total	39

List of Laboratory Experiments: (DJS22ADL5012**)**

Sr. No.	Suggested Experiments
1	Implement a genetic algorithm to solve a classic optimization problem such as the Knapsack Problem or Traveling Salesman Problem.
2	Experiment with different crossover and mutation operators to observe their impact on convergence speed and solution quality
3	Simulate an ant colony optimization algorithm to find the shortest path in a graph.
4	Train a simple feedforward neural network to classify a dataset such as the Iris dataset or MNIST handwritten digits dataset.
5	Implement a neuroevolution algorithm to evolve neural network agents for playing simple games like Tic-Tac-Toe or Flappy Bird
6	Develop an artificial immune system algorithm for anomaly detection in a synthetic dataset or network traffic data
7	Apply particle swarm optimization or other swarm intelligence algorithms to perform clustering on a dataset such as the Iris dataset or customer segmentation data
8	Investigate the properties of the memristor, such as resistance modulation and memory effects, and explore its potential applications in neuromorphic computing.

9	Investigate the properties of the memristor, such as resistance modulation and memory effects, and explore its potential applications in neuromorphic computing.
10	Implement a quantum-inspired optimization algorithm, such as quantum annealing or quantum-inspired genetic algorithms, to solve a combinatorial optimization problem
11	Develop a hybrid algorithm that combines multiple nature-inspired techniques, such as genetic algorithms and ant colony optimization, to solve a complex optimization problem.

Minimum eight experiments from the above-suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. Nature-Inspired Optimization Algorithms" by Deb, S., & Yang, X.-S. (2019).
2. Swarm Intelligence: Principles, Advances, and Applications" by Engelbrecht, A. P. (2019).
3. Bio-Inspired Computing: Theories and Applications by Islam, S. M. R., Wang, G.-G., & Zou, Z. (Eds.). (2020).

Reference Books:

1. Neuroevolution: From Architectures to Learning" by Floreano, D., Dürr, P., & Mattiussi, C. (2018).
2. Bio-Inspired Computing: Theories and Applications" by Islam, S. M. R., Wang, G.-G., & Zou, Z. (Eds.). (2020).

Prepared by Checked by Head of the Department Vice Principal Principal

Program: Third Year B.Tech. in Artificial Intelligence (AI) and Data Science	**Semester : V**
Course: Recommendation Systems	**Course Code: DJS22ADC5013**
Course : Recommendation Systems Laboratory	**Course Code: DJS22ADL5013**

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**	**Total**	
				65			**20**	**15**	**35**	**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**	

Prerequisite: -

1.Statistics for Data Science, Machine Learning-I

Objectives:

1. To provide students with the basic concepts of Recommender Systems, design space, trade-offs and its application in various domain.

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

1. Compare different types of Recommender Systems.
2. Understand various issues related to recommender system development.
3. Design a recommender system for a given problem.
4. Relate data collected from a recommender system to understand user preferences and/or behaviour.
5. Describe system evaluation methods from both algorithmic and users' perspectives

Detailed Syllabus : (unit wise)

Unit	**Description**	**Duration**
1	**Introduction to recommendation system:** Introduction and basic taxonomy of recommender systems – Traditional and non-personalized Recommender Systems, framework of recommendation system, Domain, Purpose, Context, Personalization: Personalized vs. Non-Personalized, Semi/Segment - Personalized, Privacy: user's data and trustworthiness Recommender Systems Function and Techniques, Conversational Systems, Issues working with RSs data sets: The cold-start problem, attack-resistant recommender system.	08
2	**Collaborative Filtering Recommender System** Understanding ratings and rating data, User-based nearest neighbour recommendation, Item-based nearest neighbour recommendation, Model based and pre-processing based approaches, Comparing User-Based and Item-Based recommendations, data drift and concept drift., Attacks on collaborative recommender systems.	06

3	**Content-based and knowledge based Recommender System** High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, discovering features of documents, obtaining item features from tags, representing item profiles, Methods for learning user profiles and filtering, Similarity based retrieval, Classification algorithms. Knowledge based recommendation: Knowledge representation and reasoning, Constraint-based Recommendation System User Guidance in Recommendation Processes, Calculating Recommendations, Case based recommenders.	06
4	**Neighborhood-based Recommendation System:** Neighborhood-based Recommendation, advantages, User-based Rating Prediction, User-based Classification, Item-based Recommendation, Rating Normalization, Similarity Weight Computation, Neighborhood Selection.	05
5	**Context-Aware Recommender Systems** Trust Context in Recommender Systems, Modeling Contextual Information in Recommender Systems. Paradigms for Incorporating Context in Recommender Systems: Contextual Pre-Filtering, Contextual Post-Filtering, Contextual Modeling, Combining Multiple Approaches, Issues in Context-Aware Recommender Systems. Opportunities for hybridization, Types of hybridization.	08
6	**Evaluating Recommender System** Evaluation Paradigms, General Goals of Evaluation Design, Design Issues in Offline Recommender Evaluation, Online Recommender evaluation techniques, Case Study of the Netflix Prize Data Set, Segmenting the Ratings for Training and Testing, Hold-Out, Cross Validation, Concept of Bandit Algorithm to balance exploration and exploitation. Accuracy Metrics Evaluation: RMSE versus MAE, Impact of the Long Tail, Evaluating Ranking via Correlation, Evaluating Ranking via Utility, Evaluating Ranking via Receiver Operating Characteristic.	06
	Total	39

Sr. No	List of Laboratory Experiments
1	Processing and analysis of public recommender systems datasets, and performance evaluation and comparison / Master spreadsheet-based tools.
2	Build a Recommendation Engine with Item-Based Collaborative Filterin
3	Implement Recommendation System using K-Nearest Neighbors and evaluate its performance on different dataset.
4	Compare and analyze performance of Content-based recommendation engine on different datasets for Book, Movie, Song, product Recommendation
5	Build a Recommendation Engine with Item-Based Collaborative Filtering.
6	Build project-association recommenders using association rule mining.
7	Implement Context-Aware Recommender Systems Trust.
8	Build Constraint-based Recommenders to provide valuable support for users searching for products and services in e-commerce environments.
9	Implement Hacker News algorithm /Subreddit User Recommendation System based on Netflix's Algorithm.
10	Implement Bayesian personalized ranking using matrix factorization algorithm.
11	Implement Google PageRank algorithm for recommendation.
12	Implement knowledge-based recommender system.
13	Evaluate the recommendation system with evaluation matrix.
14	Miniproject.

Minimum eight experiments from the above-suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. C.C. Aggarwal, "Recommender Systems: The Textbook", Springer, 1 st Edition, 2016.
2. Jannach D., Zanker M. and FelFering A., "Recommender Systems: An Introduction", Cambridge University Press, 1st Edition, 2011.
3. Kim Falk, "Practical Recommender Systems", Manning, 1st Edition, 2019 4. "Hands-On Recommendation Systems with Python: Start building powerful and personalized, recommendation engines with Python" by Rounak Banik , 2018.
4. Collaborative Recommendations: Algorithms, Practical Challenges And Applications by Shlomo Berkovsky (Author), Ivan Cantador (Author), Domonkos Tikk (Author)
5. Recommender System and Its Applications by Nandini Sethi (Author)
6. Building Recommender Systems: A Practical Approach by Vivek Murugesan (Author)

Reference Books:

1. M.D. Ekstrand, J.T. Riedl, J.A. Konstan, "Collaborative filtering recommender systems", Now publishers, 1 st Edition, 2011.
2. J. Leskovec, A. Rajaraman and J. Ullman, "Mining of massive datasets", Cambridge, 2 nd Edition, 2012.
3. Rounak Banik, "Hands-On Recommendation Systems with Python: Start building", Ingram short title, 2018
4. P. Pavan Kumar, S. Vairachilai, Sirisha Potluri, "Recommender Systems: Algorithms and Applications", CRC Press, 1st edition, 2021.

Online Resources:

1. Udemy course on Recommender Systems and Deep Learning in Python: https://realpython.com/build-recommendation-engine-collaborative-filtering
2. Coursera course on Recommender Systems Specialization: https://www.coursera.org/specializations/recommender-systems

Prepared by Checked by Head of the Department Vice Principal Principal

Program: Third Year B.Tech. in Artificial Intelligence (AI) and Data Science	**Semester : V**
Course: DevOps	**Course Code: DJS22ADC5014**
Course : DevOps Laboratory	**Course Code: DJS22ADL5014**

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**	**Total**	
				65			**20**	**15**	**35**	**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**	

Prerequisite: Python, Software Engineering, Software testing

Objectives:

1. The objective of this course is to familiarize learners with different development frameworks.
2. To introduce the principles and processes of software engineering and Devops.

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

1. Apply software engineering principles for application development.
2. Students will be to interpret and apply various principles, phases and activities of Agile as well as scrum methodology
3. Be able to understand and implement Devops principles for CI/CD
4. Apply testing process for application development.
5. Students will be able to apply Configuration Management Tools using Containerization

Detailed Syllabus : (unit wise)

Unit	**Description**	**Duration**
1	**Introduction:** Fundamentals of Software Engineering- process framework, Software Development Life Cycle (SDLC) Process Models: Incremental and Evolutionary. **Devops:** Introduction to Devops, definition, History of Devops, Objectives, Continuous Integration & Deployment, Containers and Virtual Development, Configuration Management Tools.	07
2	**Fundamentals of Agile Process:** Need of Agile software development, Agile Manifesto and Principles, Stakeholders and Challenges, Overview of Agile Development Models: Scrum, Extreme Programming, Feature Driven Development, Crystal, Kanban, and Lean Software Development, Business benefits of software agility.	07
3	**Source Code Management:** Version Control: GIT Features, 3-Tree Architecture, GIT – Clone /Commit / Push, GIT Hub Projects, GIT Hub Management, GIT Rebase & Merge, GIT Stash, Reset, Checkout, GIT Clone, Fetch, Pull, Membership GITHUB.	06

4	**Continuous Integration:** Continuous Delivery and Deployment, Benefits of CI/CD, Metrics to track CICD practices, Continuous integration, tools, Build & Test Applications with Continuous Integration, Scheduling build Jobs, Build Scripts, Build Pipeline, Master & Slave Node Configuration, Workspace Management, Security and plugins, Other integration tools.	06
5	**Continuous Testing:** Introduction to Selenium, Installing Selenium, Creating Test Cases in Selenium WebDriver, Run Selenium Tests in Jenkins Using Maven, Functionality Testing, UI Testing, Performance Testing, Security Testing.	07
6	**Configuration Management in Devops:** The Process of Configuration, Configuration Management in DevOps. **Configuration Management Tools Containerization:** Docker introduction, Docker Image, working with Docker Containers, Docker Engine, Creating Containers with an Image, working with Images, Docker Hub, Docker Trusted Registry, Docker File & Commands. **Devops Monitoring Tool:** Introduction to Nagios, Architecture.	06
	Total	39

Sr. No	List of Laboratory Experiments
1	Write code for a simple user registration form for an event. To Study DevOps: Principles, Practices, and DevOps Engineer Role and Responsibilities
2	To carry out Version Control System / Source Code Management, install git and create a GitHub account.
3	To Perform various GIT operations on local and Remote repositories using GIT Cheat-Sheet
4	Continuous Integration, install and configure Jenkins with Maven/Ant/Gradle to setup a build Job
5	To Build the pipeline of jobs using Maven / Gradle / Ant in Jenkins, create a pipeline script to Test and deploy an application over the tomcat server.
6	To Setup and Run Selenium Tests in Jenkins Using Maven.
7	To study Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers.
8	To study Dockerfile instructions, build an image for a sample web application using Dockerfile.
9	To install and Configure Pull based Software Configuration Management and provisioning tools using Puppet.
10	To perform Software Configuration Management and provisioning using Puppet Blocks (Manifest, Modules, Classes, Function).

Minimum eight experiments from the above-suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. Software Engineering: A Practitioner's Approach, Eight Edition by Roger S. Pressman and Bruce R. Maxim, McGraw-Hill Education, 2019.
2. Karl Matthias & Sean P. Kane, Docker: Up and Running, O'Reilly Publication, 2nd edition, 2018.
3. Len Bass, Ingo Weber, Liming Zhu,"DevOps, A Software Architects Perspective", Addison Wesley Pearson Publication, Ist edition, 2015.
4. John Ferguson Smart," Jenkins, The Definitive Guide", O'Reilly Publication 1st 2011.
5. Mastering Puppet 5: Optimize enterprise-grade environment performance with Puppet, by Ryan Russell Yates Packt Publishing (September 29, 2018)

Reference Books:

1. DevOps: Continuous Delivery, Integration, and Deployment with DevOps: Dive By Sricharan Vadapalli, Packt, 2018.
2. Agile Testing: A Practical Guide For Testers And Agile Teams, Lisa Crispin, Janet Gregory, Pearson, 2010.

3. More Agile Testing: Learning Journeys for the Whole Team By Janet Gregory, Lisa Crispin, Addison Wesley, 2015.
4. DevOps: Puppet, Docker, and Kubernetes By Thomas Uphill, John Arundel, Neependra Khare, Hideto Saito, Hui Chuan Chloe Lee, Ke-Jou Carol Hsu, Packt, 2017
5. Agile Project Management: Creating Innovative Products, Second Edition By Jim Highsmith, Addison-Wesley Professional, 2009
6. Learning Agile: Understanding Scrum, XP, Lean, and Kanban, By Andrew Stellman, Jennifer Greene, 2015, O Reilly.

Online Resources:

1. www.javatpoint.com, https://www.javatpoint.com/devops
2. www.guru99.com, https://www.guru99.com/devops-tutorial.html
3. www.tutorialspoint.com, https://www.tutorialspoint.com/devops_tutorials.htm
4. www.simplilearn.com, https://www.simplilearn.com/tutorials/devops-tutorial
5. www.edureka.co, https://www.edureka.co/blog/devops-tutorial
6. https://www.jenkins.io, https://www.jenkins.io/doc/tutorials/
7. https://github.com, https://github.com/learn/devops
8. www.dotnettricks.com, https://www.dotnettricks.com/learn/devops

Prepared by Checked by Head of the Department Vice Principal Principal

Program: Third Year B.Tech. in Artificial Intelligence (AI) and Data Science										**Semester : V**
Course: Environmental Studies										**Course Code: DJS22A3**
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**	**Total**	
				-			-	-	-	-
				Laboratory Examination			**Term work**		**Total Term work**	
1	-	--	--	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project/ presentation/ Journal**		--
				--	--	--	--	--	--	

Pre-requisite:

Interest in Environment and its impact on Human

Objectives:

1. Understand environmental issues such as depleting resources, pollution, ecological problems and the renewable energy scenario.
2. Familiarize 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 emissions and Global Warming.	4
2	**Technological Growth for Sustainable Development:** Social, Economical and Environmental aspects of Sustainable Development, Renewable Energy Harvesting, Concept of Carbon credit, Green Building, Power and functions of Central Pollution Control Board and State Pollution Control Board.	4
3	**Green Technology:** History, Agenda, and Challenges Ahead. Sustainable Cloud Computing, and Risk Management, Sustainable Software Design, Data Center Energy Efficiency, Thin-Client and Energy Efficiency.	5
	Total	13

Books Recommended:

Text books:

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

Akhgar, Morgan and Kaufman, Elsevier, 2015.

Reference Books:

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

Prepared by Checked by Head of the Department Vice Principal Principal

<table>
<tr><td colspan="8">Program: Third Year B.Tech. in Artificial Intelligence (AI) and Data Science</td><td colspan="4">Semester : V</td></tr>
<tr><td colspan="8">Course: Innovative Product Development-III</td><td colspan="4">Course Code: DJS22ILLL1</td></tr>
<tr><td colspan="4" rowspan="3">Teaching Scheme (Hours /week)</td><td colspan="8">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="4">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Total</td></tr>
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<tr><td colspan="4">Laboratory Examination</td><td colspan="3">Semester review</td><td rowspan="3">Total Term work</td><td rowspan="3">50</td></tr>
<tr><td rowspan="2">--</td><td rowspan="2">02</td><td rowspan="2">--</td><td rowspan="2">01</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td colspan="2">Tutorial / Mini project / presentation/ Journal</td></tr>
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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 analyses the impact of the proposed method of design and development of the product.
5. Develop interpersonal skills, while working as a member of the team or as the leader.
6. Demonstrate capabilities of self-learning as part of the team, leading to life-long learning, which could eventually prepare themselves to be successful entrepreneurs.
7. Demonstrate product/project management principles during the design and development work and also excel in written (Technical paper preparation) as well as oral communication.

Guidelines for the proposed product design and development:

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

Guidelines for Assessment of the work:

- The review/ progress monitoring committee shall be constituted by the Head of the Department. The progress of design and development of the product is to be evaluated on acontinuous basis, holding a minimum of two reviews in each semester.
- In the continuous assessment, focus shall also be on each individual student's contributiontothe team activity, their understanding and involvement as well as responses to the questionsbeing raised at all points in time.
- Oral examination should be conducted by Internal and External examiners. Students have to give presentation and demonstration on their working model.
- The distribution of marks for term work shall be as follows:

    1. Marks awarded by the supervisor based on log-book: 10
    2. Marks awarded by review committee: 10
    3. Quality of the write-up: 5

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

1) Quality of survey/ need identification of the product.

2) Clarity of Problem definition (design and development) based on need.

3) Innovativeness in the proposed design.

4) Feasibility of the proposed design and selection of the best solution.

5) Cost effectiveness of the product.

6) Societal impact of the product.

7) Functioning of the working model as per stated requirements.

8) Effective use of standard engineering norms.

9) Contribution of each individual as a member or the team leader.

10) Clarity on the write-up and the technical paper prepared.

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

Guidelines for Assessment of Semester Reviews:

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