॥ सा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड - ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'B++' grade

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Academic-1 (BOS) Section

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विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरण–२०२० नुसार पदवी तृतीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२६–२७ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक २२ एप्रिल २०२६ रोजी संपन्न झालेल्या मा.विद्यापरिषद बैठकीतील विषय क्र.०८/६४–२०२६ च्या ठरावानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील राष्ट्रीय शैक्षणिक धोरण–२०२० नुसार पदवी तृतीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२६–२७ पासून लागू करण्यास मा.विद्यापरिषदेने मान्यता प्रदान केली आहे. त्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील बी.एस्सी. तृतीय वर्षाचे खालील विषयाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२६–२७ पासून लागू करण्यात येत आहे.

01	B.Sc. III Year Computer Management (Single Major)
02	B.Sc. III Year Artificial Intelligence and Machine Learning (AI & ML) (Single Major)
03	B.Sc. III Year Software Development (Single Major)
04	B.Sc. III Year Data Science (Single Major)
05	B.Sc. III Year Information Technology (Single Major)
06	B.Sc. III Year Network Technology (Single Major)
07	B.Sc. III Year Software Engineering (Single Major)

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या www.srtmun.ac.in या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.:शै–१/परिपत्रक/पदवी/बीएस्सी/२०२६–२७/ ११०
दिनांक : २१.०७.२०२६

उपकुलसचिव
शैक्षणिक (१–अभ्यासमंडळे) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :–
१) मा. कुलगुरू महोदयांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. प्र.कुलगुरू महोदयांचे कार्यालय, प्रस्तुत विद्यापीठ
३) मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
४) मा. संचालक, परिक्षा व मुल्यमापन मंडळ, प्रस्तुत विद्यापीठ.
५) मा. प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED - 431 606 (MS)

(Credit Framework and Structure of

B.Sc. Artificial Intelligence and Machine Learning (AI & ML) (Single Major)

Third Year

with Multiple Entry and Exit Options as per NEP-2020)

Effective From 2026-27

UNDERGRADUATE PROGRAMME OF

SCIENCE & TECHNOLOGY

Major in **AML** and Minor in **DSM** (Subject)

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology (Three Optional in the First Year)

Credit Framework for Third Year with Multiple Entry and Exit

Subject: AML (Major) /DSM (Minor 1)

B.Sc. AI & ML (Single Major) Third Year

Year & Level	Semester	Optional 1 (Major) *(From the same Faculty)*	Optional 2 (Minor 1) *(From the same Faculty)*	Optional 3 (Minor 2) *(From the same Faculty)*	Generic Elective (GE) (select from Basket 3 of *Faculties other than Science and Technology*)	Vocational & Skill Enhancement Course	Ability Enhancement Course (AEC) (Basket 4) Value Education Courses (VEC) / Indian Knowledge System (IKS) (Basket 5) *(Common across all faculties)*	Field Work / Project/Internship/ OJT/ Apprenticeship / Case Study Or Co-curricular Courses (CCC) (Basket 6 for CCC) *(Common across all faculties)*	Credits	Total Credits
1	2	3	4	5	6	7	8	9	10	11
2 (5.0)	V	SAMLCT1301 (T 3Cr) SAMLCT1302 (T 3Cr) SAMLIK1303 (T 2Cr) SAMLCP1304 (P 2Cr) SAMLCP1305 (P 2Cr) **12 Credits**	SAMLET1301 (T 3Cr) SAMLEP1301 (P 1Cr) **4 Credits**	--		SAMLVC1301 **2 Credits**		SAMLFP1301 **4 Credits**	22	44
	VI	SAMLCT1351 (T 3Cr) SAMLCT1352 (T 3Cr) SAMLCT1353 (T 2Cr) SAMLCP1354 (P 2Cr) SAMLCP1355 (P 2Cr) **12 Credits**	SAMLET1351 (T 3Cr) SAMLEP1351 (P 1Cr) **4 Credits**	--		SAMLVC1351 **2 Credits**		SAMLOJ1351 **4 Credits**	22	
	Cum. Cr.	24	08	00	00	06	00	06	44	

Abbreviations:

1. **DSC:** Department/Discipline Specific Core (Major)
2. **DSE:** Department/Discipline Specific Elective (Major)
3. **DSM:** Discipline Specific Minor
4. **GE/OE:** Generic/Open Elective
5. **VSEC:** Vocational Skill and Skill Enhancement Course
6. **VSC:** Vocational Skill Courses
7. **SEC:** Skill Enhancement Courses
8. **AEC:** Ability Enhancement courses
9. **MIL:** Modern Indian languages
10. **IKS:** Indian Knowledge System
11. **VEC:** Value Education Courses
12. **OJT:** On Job Training: (Internship/Apprenticeship)
13. **FP:** Field Projects
14. **CEP:** Community Engagement and Service
15. **CC:** Co-Curricular Courses
16. **RM:** Research Methodology
17. **RP:** Research Project/Dissertation

B. Sc. AI and ML Third Year Semester V *(Level 5.5)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs./ week)	
			Theory	Practical	Total	Theory	Practical
Optional 1	SAMLCT1301	Natural Language Processing	03	--	**12**	04	--
	SAMLCT1302	Machine Learning Algorithms	03	--		04	--
	SAMLIK1303	Introduction to super computing	02	--		02	
	SAMLCP1304	Natural Language Processing (P)	--	02		--	02
	SAMLCP1305	Machine Learning Algorithms (P)	--	02		--	02
Optional 2	SAMLET1301	Introduction to Cloud Computing	03	--	**04**	04	--
	SAMLEP1301	Introduction to Cloud Computing (P)	--	01		--	02
Vocational & Skill Enhancement Course	SAMLVC1301	IOT	--	02	**02**	--	02
Field Work / Project/Internship	SAMLFP1301	Project	--	04	**04**	--	04
Total Credits			**11**	**11**	**22**	**14**	**12**

B. Sc. AI and ML Third Year Semester V *(Level 5.5)*

Examination Scheme

[40% Continuous Assessment (CA) and 60% End Semester Assessment (ESA)]

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Sum of T1 & T2 (6)	Total (7)	CA (8)	ESA (9)	
Optional 1	SAMLCT1301	Natural Language Processing	15	15	30	45	--	--	75
	SAMLCT1302	Machine Learning Algorithms	15	15	30	45	--	--	75
	SAMLIK1303	Introduction to super computing	10	10	20	30	--	--	50
	SAMLCP1304	Natural Language Processing (P)	--	--	--	--	20	30	50
	SAMLCP1305	Machine Learning Algorithms (P)	--	--	--	--	20	30	50
Optional 2	SAMLET1301	Introduction to Cloud Computing	15	15	30	45	--	--	75
	SAMLEP1301	Introduction to Cloud Computing (P)	--	--	--	--	10	15	25
Vocational & Skill Enhancement Course	SAMLVC1301	IOT	--	--	--	--	20	30	50
Field Work / Project/Internship	SAMLFP1301	Project	--	--	--	--	40	60	100

B. Sc. AI and ML Third Year Semester V *(Level 5.5)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs./ week)	
			Theory	Practical	Total	Theory	Practical
Optional 1	SAMLCT1351	Computer Vision and Image Analysis	03	--	**12**	04	--
	SAMLCT1352	Deep Learning	03	--		04	--
	SAMLCT1353	AI in Robotics and Automation	02	--		02	
	SAMLCP1354	Computer Vision and Image Analysis (P)	--	02		--	02
	SAMLCP1355	Deep Learning (P)	--	02		--	02
Optional 2	SAMLET1351	Feature engineering	03	--	**04**	04	--
	SAMLEP1351	Feature engineering (P)	--	01		--	02
Vocational & Skill Enhancement Course	SAMLVC1351	Prompt Engineering	--	02	**02**	--	02
Field Work / Project/Internship	SAMLOJ1351	OJT	--	04	**04**	--	04
Total Credits			**11**	**11**	**22**	**14**	**12**

B. Sc. AI and ML Third Year Semester V *(Level 5.5)*

Examination Scheme

[40% Continuous Assessment (CA) and 60% End Semester Assessment (ESA)]

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Sum of T1 & T2 (6)	Total (7)	CA (8)	ESA (9)	
Optional 1	SAMLCT1351	Computer Vision and Image Analysis	15	15	30	45	--	--	75
	SAMLCT1352	Deep Learning	15	15	30	45	--	--	75
	SAMLCT1353	AI in Robotics and Automation	10	10	20	30	--	--	50
	SAMLCP1354	Computer Vision and Image Analysis (P)	--	--	--	--	20	30	50
	SAMLCP1355	Deep Learning (P)	--	--	--	--	20	30	50
Optional 2	SAMLET1351	Feature engineering	15	15	30	45	--	--	75
	SAMLEP1351	Feature engineering (P)	--	--	--	--	10	15	25
Vocational & Skill Enhancement Course	SAMLVC1351	Prompt Engineering	--	--	--	--	20	30	50
Field Work / Project/Internship	SAMLOJ1351	OJT	--	--	--	--	40	60	100

Detailed Curriculum

Course Structure:

Major 1 – Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SAMLCT1301	Natural Language Processing	45	--	03	--	03

Major 1 – Assessment Scheme

Course Code (1)	Course Name (Paper Title) (2)	Theory				Practical		Total [Col (5+6) Or Col (7+8)]
		CA			ESA (6)			
		Test I (3)	Test II (4)	Sum of T1 & T2 (5)		CA (7)	ESA (8)	
SAMLCT1301	Natural Language Processing	15	15	30	45	--	--	75

SAMLCT1301: Natural Language Processing (Major 1) Curriculum Details

Course pre-requisite:

1. **Programming Knowledge:** Basic proficiency in programming using Python, including data structures (lists, dictionaries, strings) and file handling.
2. **Mathematics Fundamentals:** Understanding of basic concepts from: Linear Algebra (vectors, matrices) Probability and Statistics (mean, variance, probability concepts)
3. **Basics of Machine Learning:** Familiarity with fundamental concepts of Machine Learning, such as supervised learning, classification, and model evaluation.
4. **Data Handling Skills:** Ability to work with datasets using libraries like Pandas and NumPy.

Course Objectives:

1. This course provides a comprehensive foundation in Natural Language Processing from classical linguistic theories and statistical methods to modern deep learning architectures.
2. large language models. Students will develop practical skills to build intelligent text processing systems for real-world applications including chatbots, machine translation, sentiment analysis, and question answering.
3. Students will implement text pre-processing pipelines including tokenization, stemming, lemmatization, POS tagging, and NER using NLP libraries like NLTK, spaCy, Gensim, Tensorflow etc.

Course Outcomes:

1. Understand and explain fundamental concepts of Natural Language Processing, including its components, challenges, and real-world applications.
2. Apply basic text preprocessing techniques such as tokenization, stemming, lemmatization, and stop-word removal using standard NLP libraries.
3. Represent textual data using methods like Bag of Words, TF-IDF, and word embeddings.
4. Analyze syntactic and semantic structures of language using techniques such as part-of-speech tagging and parsing.
5. Build and evaluate basic NLP models for tasks like text classification, sentiment analysis, and named entity recognition.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		**Introduction to Natural Language Processing**	11 Hrs
	1.1	Introduction to NLP and its Importance	
	1.2	Challenges in NLP (Ambiguity, Context, etc.) Steps in NLP: Tokenization, Morphology, Syntax, Semantics, and Pragmatics	
	1.3	Linguistic Concepts: Phonology, morphology, syntax, semantics, pragmatics; levels of language analysis; morphemes, lexemes, phrases, sentences	
	1.4	Text Preprocessing: Tokenization (word, sentence, subword); stopword removal; lowercasing; punctuation and noise removal; sentence segmentation	
	1.5	Stemming & Lemmatization: Porter, Lancaster, Snowball stemmers; WordNet lemmatizer; differences and trade-offs; NLTK and spaCy implementations	
2.0		**Text Pre-processing and Representation**	11 Hrs
	2.1	Text Cleaning and Preprocessing: Tokenization, Stopword Removal, Stemming, Lemmatization	
	2.2	Bag of Words (BoW) Model and TF-IDF Word Embeddings: Word2Vec, GloVe, FastText	
	2.3	N-gram Language Models	

		N-Grams, Evaluating Language Models: Training and Test Sets, Evaluating Language Models: Perplexity,	
	2.4	Sampling sentences from a language model, Generalizing vs. overfitting the training set, Smoothing, Interpolation, and Backoff , Advanced: Perplexity's Relation to Entropy	
	2.5	Text Classification, and Sentiment Naive Bayes Classifiers, Training the Naive Bayes Classifier, worked example, optimizing for Sentiment Analysis, Naive Bayes for other text classification tasks, Naive Bayes as a Language	
3.0		**Syntax and Parsing Semantics and Word Sense Disambiguation**	11 Hrs
	3.1	Part-of-Speech (POS) Tagging: Rule-Based, Statistical, and Neural Approaches	
	3.2	Dependency Parsing and Constituency Parsing, Grammar and Context-Free Grammars, Probabilistic Parsing (CYK Algorithm, Earley's Algorithm)	
	3.3	Lexical Semantics and WordNet Word Sense Disambiguation (WSD) Techniques	
	3.4	Semantic Role Labelling, Distributional Semantics: Latent Semantic Analysis (LSA), Latent Dirichlet Allocation (LDA)	
	3.5	Model, Evaluation: Precision, Recall, F-measure, Test sets and Cross-validation, Statistical Significance Testing, Avoiding Harms in Classification	
4.0		**Large Language Models**	12 Hrs
	4.1	Large Language Models with Transformers, Sampling for LLM Generation, Pretraining Large Language Models, Evaluating Large Language Models	
	4.2	Recurrent Neural Networks (RNN): Sequence modelling, hidden state, BPTT; vanishing gradient problem; applications in language modelling; one-to-many, many-to-many architectures	
	4.3	LSTM & GRU: Long Short-Term Memory: forget, input, output gates; Gated Recurrent Unit; bidirectional LSTM; stacked LSTMs;	
	4.4	Sequence-to-Sequence Models: Encoder-decoder architecture; teacher forcing; beam search decoding; applications in machine translation, summarization, chatbots	
		Total	**45 Hrs**

Text Books:

1. Daniel Jurafsky & James H. Martin Speech and Language Processing (3rd Ed. Draft) Prentice Hall / Online 2023.
2. Steven Bird, Ewan Klein & Edward Loper Natural Language Processing with Python (NLTK Book) O'Reilly Media 2009.
3. Hobson Lane, Hannes Hapke & Cole Howard Natural Language Processing in Action Manning Publications 2019.
4. Lewis Tunstall, Leandro von Werra & Thomas Wolf Natural Language Processing with Transformers O'Reilly Media 2022.
5. Yoav Goldberg Neural Network Methods for Natural Language Processing Morgan & Claypool 2017.
6. Christopher Manning & Hinrich Schütze Foundations of Statistical Natural Language Processing MIT Press 1999.
7. Hugging Face Documentation Transformers Library — Model Hub & Tutorials huggingface.co 2024.

Reference Books:

1. Yoav Goldberg Neural Network Methods for Natural Language Processing Morgan & Claypool 2017.
2. Jacob Devlin et al. BERT: Pre-training of Deep Bidirectional Transformers NAACL 2019 (arXiv:1810.04805) 2019.
3. Ashish Vaswani et al. Attention Is All You Need NeurIPS 2017 (arXiv:1706.03762) 2017.
4. Christopher Manning & Hinrich Schütze Foundations of Statistical Natural Language Processing MIT Press 1999
5. Dipanjan Sarkar Text Analytics with Python (2nd Ed.) Apress / Springer 2019.
6. Hugging Face Documentation Transformers Library — Model Hub & Tutorials huggingface.co 2024.

Course Structure:

Major 2 – Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SAMLCT1302	Machine Learning Algorithms	45	--	03	--	03

Major 2 – Assessment Scheme

Course Code (1)	Course Name (Paper Title) (2)	Theory				Practical		Total [Col (5+6) Or Col (7+8)
		CA			ESA (6)			
		Test I (3)	Test II (4)	Sum of T1 & T2 (5)		CA (7)	ESA (8)	
SAMLCT1302	Machine Learning Algorithms	15	15	30	45	--	--	75

SAMLCT1302: Machine Learning Algorithms (Major 2) Curriculum Details

Course pre-requisite:

1. Mathematics for AI/ML — Linear Algebra (vectors, matrices, eigenvalues), Probability Theory (Bayes theorem, distributions), Calculus (gradients, chain rule, partial derivatives)
2. Programming in Python — data types, control flow, functions, OOP, file handling, list comprehensions
3. Introduction to Machine Learning — supervised vs. unsupervised learning, train-test split, bias-variance tradeoff, cross-validation, evaluation metrics (accuracy, precision, recall, F1, ROC-AUC)
4. Data Handling — Pandas, NumPy for data wrangling, cleaning, and transformation; Matplotlib/Seaborn for visualization
5. Statistics — descriptive statistics, hypothesis testing, correlation, regression concepts
6. Feature Engineering — data preprocessing, normalization, encoding (completion of AIML-501 or equivalent is advantageous)

Course Objectives:

This course aims to provide students with a rigorous, implementation-oriented understanding of the most widely used machine learning algorithms and their theoretical foundations. On completing this course, students will have moved from being consumers of ML libraries to informed designers of ML systems. Specific objectives are:

1. Provide a unified mathematical and probabilistic framework for understanding both classical and modern machine learning techniques.
2. Develop deep understanding of linear models — Linear Regression, Logistic Regression, and Regularisation (Lasso, Ridge, Elastic Net) — as foundations for more advanced algorithms.
3. Enable students to apply tree-based and ensemble methods — Decision Trees, Random Forests, Gradient Boosting, XGBoost, LightGBM — to structured and tabular datasets.
4. Introduce kernel-based and distance-based methods — Support Vector Machines, K-Nearest Neighbours, Naive Bayes — with their mathematical derivations and hyperparameter tuning strategies.
5. Establish understanding of unsupervised learning methods — Clustering (K-Means, DBSCAN, Hierarchical), Dimensionality Reduction (PCA, t-SNE, UMAP) — and their real-world applications.
6. Train students in systematic model selection, hyperparameter optimisation (Grid Search, Random Search, Bayesian Optimisation), and ML pipeline construction using Scikit-learn.

Course Outcomes:

1. CO1. Formulate a machine learning problem mathematically — define the hypothesis space, loss function, and optimisation objective — and select appropriate algorithms based on data characteristics and task requirements. (Bloom's Level: Analyse)
2. CO2. Implement, train, and evaluate supervised learning algorithms — including Linear/Logistic Regression, Decision Trees, SVMs, Naive Bayes, and Ensemble Methods — using Python and Scikit-learn on real datasets. (Bloom's Level: Apply)
3. CO3. Apply ensemble strategies (Bagging, Boosting, Stacking) and tune hyperparameters using cross-validation and search strategies to systematically improve model generalisation. (Bloom's Level: Evaluate)
4. CO4. Design and execute unsupervised learning workflows — clustering, anomaly detection, and dimensionality reduction — and validate results using internal and external evaluation metrics. (Bloom's Level: Create)
5. Build end-to-end ML pipelines that integrate preprocessing, feature engineering, model training, evaluation, and basic deployment readiness, with documented model interpretability using SHAP or LIME. (Bloom's Level: Create)

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Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		**Introduction to Machine Learning**	11 **Hrs.**
	1.1	What is Machine Learning, Artificial Intelligence and Machine Learning? Applications of Machine Learning Overview of Machine Learning Algorithms	
	1.2	Supervised Learning, Unsupervised Learning Semi Supervised Learning, Reinforcement Learning	
	1.3	Regression: Linear regression, Multiple regression, polynomial linear regression, Logistic Regression	
	1.4	Classification: Naïve Bayes, K-Nearest Neighbors, Decision Tree, Support Vector Machines	
2.0		**Tree-Based Methods and Ensemble Learning**	11 **Hrs.**
	2.1	Decision Trees — ID3, C4.5, CART; Gini impurity, entropy, information gain, pruning 0f Tree	
	2.2	Bagging and Random Forests — bootstrap aggregation, out-of-bag error, feature importance.	
	2.3	Boosting — AdaBoost, Gradient Boosting (GBM); additive model framework	
	2.4	fitting / Overfitting, Cross-Validation	
3.0		**Dimensionality & Support Vector Machine**	11 **Hrs.**
	3.1	Principal Component Analysis, Eigen Values & Eigen Vectors, Singular Value Decomposition	
	3.2	Decision Boundaries for Support Vector Machine	
	3.3	Support Vector Machines — maximum margin classifier, primal and dual formulation, KKT conditions	
	3.4	Linear & Non-Linear Cases, Kernel Function (Linear, Polynomial, Radial Basis Function, Sigmoid, Wavelet, Hyperbolic Tangent)	
4.0		**Unsupervised Learning And Reinforcement Learning**	12 **Hrs.**

	4.1	Introduction - Clustering Algorithms, K – Means, K-Means — Lloyd's algorithm, initialisation (K-Means++),	
	4.2	Hierarchical Clustering : agglomerative approach, dendrograms, linkage criteria	
	4.3	Cluster Validity, elbow method, inertia, Dimensionality Reduction –Principal Component Analysis	
	4.4	Probability Density Estimation, Sequence Models, Markov Models – Hidden Markov Models, K-Nearest Neighbours	
	4.5	Hyperparameter Tuning: Grid Search, Random Search, Bayesian Optimization Regularization Techniques: L1, L2 Regularization, Dropout Model Interpretability: SHAP, LIME	
		Total	**45 Hrs**

Text Books:

1. Christopher M. Bishop — Pattern Recognition and Machine Learning, Springer, 2006. (Comprehensive Bayesian treatment of ML algorithms)
2. Aurelien Geron — Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly, 3rd Ed., 2022. (Primary practical reference)
3. Kevin P. Murphy — Machine Learning: A Probabilistic Perspective, MIT Press, 2012. (Mathematical depth)

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman — The Elements of Statistical Learning, Springer, 2nd Ed., 2009. (Free PDF at web.stanford.edu/~hastie/ElemStatLearn/)
2. Sebastian Raschka and Vahid Mirjalili — Python Machine Learning, Packt, 3rd Ed., 2019. (Chapter 3–7 on classifiers; Chapter 11 on ensemble methods)
3. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani — An Introduction to Statistical Learning (ISLR), Springer, 2nd Ed., 2021. (Free PDF: statlearning.com)
4. Jake VanderPlas — Python Data Science Handbook, O'Reilly, 2016.

Course Structure:

Major 3 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SAMLIK1303	Introduction to Super Computing	30	--	2	--	2

Major 3 -Assessment Scheme

Course Code (1)	Course Name (Paper Title) (2)	Theory				Practical		Total [Col (5+6) Or Col (7+8)
		CA			ESA (6)			
		Test I (3)	Test II (4)	Sum of T1 & T2 (5)		CA (7)	ESA (8)	
SAMLIK1303	Introduction to Super Computing	10	10	20	30	--	--	50

SAMLIK1303: Introduction to Super Computing (Major 3) Curriculum Details

Course pre-requisite:

1. Basic knowledge of computer organization and architecture.
2. Familiarity with programming in C/C++ or Python.
3. Understanding of data structures and algorithms.
4. Introductory knowledge of operating systems and networking.

Course Objectives:

1. To introduce the fundamentals of supercomputing and high-performance computing (HPC), including architecture and evolution.
2. To understand the contributions of Dr. Vijay Bhatkar and India's PARAM supercomputers developed by Centre for Development of Advanced Computing.
3. To develop the ability to design and implement parallel programs using modern programming models (MPI, OpenMP, CUDA).
4. To analyze and evaluate performance metrics and optimization techniques in HPC systems.
5. To explore real-world applications and future trends in supercomputing.

Course Outcomes:

After completing this course, students will be able to:

1. Explain the architecture, evolution, and significance of supercomputers, including systems like PARAM series.
2. Apply parallel computing models and programming paradigms (MPI, OpenMP, CUDA) to solve computational problems.
3. Analyze performance metrics (FLOPS, latency, scalability laws) and optimize parallel programs.
4. Design and implement efficient parallel algorithms for scientific and engineering applications.
5. Evaluate the impact of national initiatives like the National Supercomputing Mission and emerging technologies such as AI-HPC convergence.
6. Demonstrate hands-on skills in executing and analyzing parallel programs on cluster-based systems.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		**Foundations of Supercomputing & Dr. Vijay Bhatkar's Contribution**	7
	1.1	Introduction to Supercomputing: Definition, need, evolution from mainframes to supercomputers	
	1.2	History in India: Role of Dr. Vijay Bhatkar, PARAM series, C-DAC's mission	
	1.3	Supercomputer Architecture Basics: Vector processors, SIMD, MIMD, cluster computing	
	1.4	Performance Metrics: FLOPS, MIPS, latency, bandwidth, Amdahl's Law, Gustafson's Law	
2.0		**Parallel Processing & High Performance Computing Architecture**	8
	2.1	Parallel Computing Models: Shared memory, distributed memory, hybrid models	
	2.2	Interconnection Networks: Topologies – mesh, hypercube, torus, fat tree	
	2.3	Memory Hierarchy: Cache coherence, NUMA, distributed shared memory	
	2.4	Case Study: Architecture of PARAM 8000, PARAM Yuva, PARAM Siddhi-AI	
	2.5	Programming Paradigms: MPI, OpenMP, CUDA basics	

3.0		**Software, Tools & Programming for Supercomputers**	7
	3.1	Operating Systems for HPC: Linux variants for clusters, scheduling	
	3.2	Parallel Algorithms: Matrix multiplication, sorting, graph algorithms	
	3.3	Programming Environments: MPI programming, OpenMP directives, GPU programming	
	3.4	Performance Optimization: Load balancing, profiling tools, debugging parallel code	
4.0		**Applications & Future of Supercomputing**	8
	4.1	Scientific Applications: Weather forecasting, computational fluid dynamics, genomics	
	4.2	National Missions: National Supercomputing Mission, applications in defense, space, disaster management	
	4.3	Emerging Trends: Exascale computing, AI + HPC convergence, quantum computing overview	
	4.4	Ethical & Societal Impact: Digital divide, indigenous tech development, Bhatkar's vision for self-reliance	
		Total	**30**

Text Books:

1. Elements of Parallel Computing – Vijay P. Bhatkar
   Covers fundamentals of parallel computing, architectures, and Indian supercomputing initiatives including PARAM.
2. Introduction to Parallel Processing – M. Sasikumar, D. Shikhare, P. Ravi Prakash
   Provides a clear introduction to parallel algorithms, models, and programming techniques.
3. Parallel Computer Architecture: A Hardware/Software Approach – John L. Hennessy, David A. Patterson
   Detailed coverage of modern parallel architectures, performance, and scalability.
4. Using MPI: Portable Parallel Programming with the Message Passing Interface – William Gropp, Ewing Lusk, Anthony Skjellum
   Comprehensive guide to MPI programming for distributed memory systems.

Reference Books:

1. Elements of Parallel Computing_ by Vijay P. Bhatkar
2. Introduction to Parallel Processing_ by Sasikumar, Shikhare, Ravi Prakash
3. C-DAC whitepapers on PARAM series

Course Structure:

Major 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SAMLCP1304	Natural Language Processing(P)	--	20	--	02	02

Major 1 -Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SAMLCP1304	Natural Language Processing(P)	--	--	--	--	20	30	50

SAMLCP1304: Natural Language Processing (P) Curriculum Details

Course pre-requisite:

1. **Programming Knowledge:** Basic proficiency in programming using Python, including data structures (lists, dictionaries, strings) and file handling.
2. **Mathematics Fundamentals :** Understanding of basic concepts from:Linear Algebra (vectors, matrices) Probability and Statistics (mean, variance, probability concepts)
3. **Basics of Machine Learning:** Familiarity with fundamental concepts of Machine Learning, such as supervised learning, classification, and model evaluation.
4. **Data Handling Skills :** Ability to work with datasets using libraries like Pandas and NumPy.

Course Objectives:

1. This course provides a comprehensive foundation in Natural Language Processing from classical linguistic theories and statistical methods to modern deep learning architectures.
2. large language models. Students will develop practical skills to build intelligent text processing systems for real-world applications including chatbots, machine translation, sentiment analysis, and question answering.
3. Students will implement text preprocessing pipelines including tokenization, stemming, lemmatization, POS tagging, and NER using NLP libraries like NLTK, spaCy, Gensim, Tensorflow etc.

Course Outcomes:

1. Understand and explain fundamental concepts of Natural Language Processing, including its components, challenges, and real-world applications.
2. Apply basic text preprocessing techniques such as tokenization, stemming, lemmatization, and stop-word removal using standard NLP libraries.
3. Represent textual data using methods like Bag of Words, TF-IDF, and word embeddings.
4. Analyze syntactic and semantic structures of language using techniques such as part-of-speech tagging and parsing.
5. Build and evaluate basic NLP models for tasks like text classification, sentiment analysis, and named entity recognition.

Curriculum Details:

List of Practical

1. **Practical 1: Basic Text Preprocessing**
   - Perform tokenization (word & sentence)
   - Remove stopwords, punctuation, and convert text to lowercase
   - **Tools:** NLTK / spaCy
2. **Practical 2: Stemming & Lemmatization**
   - Implement Porter, Lancaster stemming
   - Apply WordNet lemmatization
   - Compare outputs
3. **Practical 3: Text Cleaning Pipeline**
   - Create reusable preprocessing pipeline
   - Handle noisy text (URLs, emojis, special characters)
4. **Practical 4: Bag of Words (BoW)**
   - Convert text into BoW representation
   - Visualize word frequency
5. **Practical 5: TF-IDF Implementation**
   - Compute TF-IDF vectors
   - Compare with BoW
6. **Practical 6: Word Embeddings**
   - Generate embeddings using Word2Vec / GloVe
   - Visualize similar words
7. **Practical 7: N-gram Language Model**

- Build unigram, bigram, trigram models
- Generate sample sentences

8. **Practical 8: Sentiment Analysis using Naive Bayes**
   - Train classifier on dataset
   - Evaluate accuracy
9. **Practical 9: Part-of-Speech (POS) Tagging**
   - Implement POS tagging
   - Analyze tagged sentences
10. **Practical 10: Named Entity Recognition (NER)**
    - Extract entities (Person, Location, Organization)
    - Visualize results
11. **Practical 11: Parsing Techniques**
    - Perform dependency parsing
    - Visualize parse trees
12. **Practical 12: Word Sense Disambiguation**
    - Use WordNet for sense identification
    - Compare meanings in context
13. **Practical 13: Topic Modeling**
    - Implement LDA (Latent Dirichlet Allocation)
    - Extract topics from dataset
14. **Practical 14: Text Classification using Deep Learning**
    - Build model using TensorFlow or Keras
    - Train on text dataset
15. **Practical 15: Transformer-based NLP Application**
    - Use Hugging Face Transformers
    - Perform:
      - Text summarization OR
      - Question answering OR
      - Chatbot implementation

Text Books:

1. Daniel Jurafsky & James H. Martin Speech and Language Processing (3rd Ed. Draft) Prentice Hall / Online 2023.
2. Steven Bird, Ewan Klein & Edward Loper Natural Language Processing with Python (NLTK Book) O'Reilly Media 2009.
3. Hobson Lane, Hannes Hapke & Cole Howard Natural Language Processing in Action Manning Publications 2019.
4. Lewis Tunstall, Leandro von Werra & Thomas Wolf Natural Language Processing with Transformers O'Reilly Media 2022.
5. Yoav Goldberg Neural Network Methods for Natural Language Processing Morgan & Claypool 2017.
6. Christopher Manning & Hinrich Schütze Foundations of Statistical Natural Language Processing MIT Press 1999.
7. Hugging Face Documentation Transformers Library — Model Hub & Tutorials huggingface.co 2024.

Reference Books:

1. Yoav Goldberg Neural Network Methods for Natural Language Processing Morgan & Claypool 2017.
2. Jacob Devlin et al.BERT: Pre-training of Deep Bidirectional Transformers NAACL 2019 (arXiv:1810.04805) 2019.
3. Ashish Vaswani et al. Attention Is All You Need NeurIPS 2017 (arXiv:1706.03762) 2017.
4. Christopher Manning & Hinrich Schütze Foundations of Statistical Natural Language Processing MIT Press 1999
5. Dipanjan Sarkar Text Analytics with Python (2nd Ed.) Apress / Springer 2019.
6. Hugging Face Documentation Transformers Library — Model Hub & Tutorials huggingface.co 2024.

Course Structure:

Major 2 – Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SAMLCP1305	Machine Learning Algorithms(P)	--	20	--	02	02

Major 2 – Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SAMLCP1305	Machine Learning Algorithms(P)	--	--	--	--	20	30	50

SAMLCP1305: Machine Learning Algorithms(P) Curriculum Details

Course pre-requisite:

1. Mathematics for AI/ML — Linear Algebra (vectors, matrices, eigenvalues), Probability Theory (Bayes theorem, distributions), Calculus (gradients, chain rule, partial derivatives)
2. Programming in Python — data types, control flow, functions, OOP, file handling, list comprehensions
3. Introduction to Machine Learning — supervised vs. unsupervised learning, train-test split, bias-variance tradeoff, cross-validation, evaluation metrics (accuracy, precision, recall, F1, ROC-AUC)
4. Data Handling — Pandas, NumPy for data wrangling, cleaning, and transformation; Matplotlib/Seaborn for visualization
5. Statistics — descriptive statistics, hypothesis testing, correlation, regression concepts
6. Feature Engineering — data preprocessing, normalization, encoding

Course Objectives:

1. Provide a unified mathematical and probabilistic framework for understanding both classical and modern machine learning techniques.
2. Develop deep understanding of linear models — Linear Regression, Logistic Regression, and Regularisation (Lasso, Ridge, Elastic Net) — as foundations for more advanced algorithms.

3. Enable students to apply tree-based and ensemble methods — Decision Trees, Random Forests, Gradient Boosting, XGBoost, LightGBM — to structured and tabular datasets.
4. Introduce kernel-based and distance-based methods — Support Vector Machines, K-Nearest Neighbours, Naive Bayes — with their mathematical derivations and hyperparameter tuning strategies.
5. Establish understanding of unsupervised learning methods — Clustering (K-Means, DBSCAN, Hierarchical), Dimensionality Reduction (PCA, t-SNE, UMAP) — and their real-world applications.
6. Train students in systematic model selection, hyperparameter optimisation (Grid Search, Random Search, Bayesian Optimisation), and ML pipeline construction using Scikit-learn.

Course Outcomes:

1. CO1) Formulate a machine learning problem mathematically — define the hypothesis space, loss function, and optimisation objective — and select appropriate algorithms based on data characteristics and task requirements.
2. CO2) Implement, train, and evaluate supervised learning algorithms — including Linear/Logistic Regression, Decision Trees, SVMs, Naive Bayes, and Ensemble Methods — using Python and Scikit-learn on real datasets.
3. CO3) Apply ensemble strategies (Bagging, Boosting, Stacking) and tune hyperparameters using cross-validation and search strategies to systematically improve model generalisation.
4. CO4) Design and execute unsupervised learning workflows — clustering, anomaly detection, and dimensionality reduction — and validate results using internal and external evaluation metrics.
5. CO5) Build end-to-end ML pipelines that integrate preprocessing, feature engineering, model training, evaluation, and basic deployment readiness, with documented model interpretability using SHAP or LIME.

Curriculum Details:

List of Practical

1. Exploratory Data Analysis and Data Preprocessing
2. Logistic Regression for Binary and Multi-Class Classification
3. Simple and Multiple Linear Regression
4. Classification: Naïve Bayes, K-Nearest Neighbors,
5. Decision Tree,
6. Support Vector Machines: Linear and Kernel SVM
7. Regularised Regression — Ridge, Lasso, and Elastic Net
8. Decision Tree Classifier — Training, Pruning and Visualisation
9. Naive Bayes Classifier — Text and Tabular Data
10. K-Nearest Neighbours — Classification and Regression
11. K-Means Clustering and Cluster Evaluation
12. Random Forest — Feature Importance and Out-of-Bag Evaluation
13. Gradient Boosting and XGBoost — Structured Data Classification
14. Ensemble Methods — Bagging, Voting Classifier, and Stacking
15. Dimensionality Reduction with PCA

Text Books:

1. Christopher M. Bishop — Pattern Recognition and Machine Learning, Springer, 2006. (Comprehensive Bayesian treatment of ML algorithms)
2. Aurelien Geron — Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly, 3rd Ed., 2022. (Primary practical reference)
3. Kevin P. Murphy — Machine Learning: A Probabilistic Perspective, MIT Press, 2012. (Mathematical depth)

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman — The Elements of Statistical Learning, Springer, 2nd Ed., 2009. (Free PDF at web.stanford.edu/~hastie/ElemStatLearn/)
2. Sebastian Raschka and Vahid Mirjalili — Python Machine Learning, Packt, 3rd Ed., 2019. (Chapter 3–7 on classifiers; Chapter 11 on ensemble methods)
3. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani — An Introduction to Statistical Learning (ISLR), Springer, 2nd Ed., 2021. (Free PDF: statlearning.com)
4. Jake VanderPlas — Python Data Science Handbook, O'Reilly, 2016.

Course Structure:

Minor 1 -Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SAMLET1301	Introduction to Cloud Computing	45	--	03	--	03

Minor 1–Assessment Scheme

Course Code (1)	Course Name (Paper Title) (2)	Theory				Practical		Total [Col (5+6) Or Col (7+8)]
		CA			ESA (6)			
		Test I (3)	Test II (4)	Sum of T1 & T2 (5)		CA (7)	ESA (8)	
SAMLET1301	Introduction to Cloud Computing	15	15	30	45	--	--	75

SAMLET1301: Introduction to Cloud Computing (Minor 1) Curriculum Details

Course pre-requisite:

1. Fundamentals of Computer Systems
2. Operating System Basics
3. Computer Networks (Basic Level)
4. Basic Database Knowledge

Course Objectives:

1. To introduce the fundamental concepts of cloud computing, including cloud models, service types, and the shared responsibility model.
2. To familiarize students with the basics of Microsoft Azure and its core architectural components.
3. To understand various Azure services such as computer, networking, storage, identity, and security.

Course Outcomes:

1. Apply Azure services to create, configure, and manage cloud resources such as virtual machines, storage accounts, and virtual networks.

2. Analyse factors affecting cost in Azure and utilize tools like pricing calculator and cost management for optimization.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0	**1**	**Introduction cloud Comuting concepts**	13
	1.1	Introduction to Microsoft Azure Fundamentals	
	1.2	Introduction to cloud computing	
	1.3	What is cloud computing And Define cloud models?	
	1.4	shared responsibility model	
	1.5	Benefits of using cloud services	
	1.6	Cloud service types	
2.0	2	**Describe Azure architecture and services**	12
	2.1	Core Architectural components of Azure	
	2.2	Azure compute services	
	2.3	Azure networking services	
	2.4	Azure storage services	
	2.5	Azure identity, access, and security	
3.0	3	**Azure management and governance**	10
	3.1	Describe factors that can affect costs in Azure, Explore the pricing calculator	
	3.2	Microsoft Cost Management tool	
	3.3	What is purpose of tags?	
	3.4	Cost Optimization options in Azure	
4.0	**4**	**Features and tools for managing and deploying Azure resources**	10
	4.1	Tools for interacting with Azure	
	4.2	Azure Resource Manager and Azure ARM templates	
	4.3	Azure Advisor	
	4.4	Azure Service Health	
	4.5	Concept of Azure Monitor	
		Total	45

Text Books:

1. Thomas Erl, Ricardo Puttini, Zaigham Mahmood, “Cloud Computing: Concepts, Technology & Architecture”, First Edition, Pearson, 2013.
2. Anthony Puca, Michael Washam,“Exam Ref AZ-900 Microsoft Azure Fundamentals”, Second Edition, Microsoft Press, 2022.
3. Rajkumar Buyya, James Broberg, Andrzej Goscinski, “Cloud Computing: Principles and Paradigms”, First Edition, Wiley, 2011.

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, “Mastering Cloud Computing”, First Edition, McGraw Hill Education, 2013.

Course Structure:

Minor 1-Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SAMLEP1301	Fundamental of Cloud Computing (P)	--	10	--	01	01

Minor 1-Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SAMLEP1301	Fundamental of Cloud Computing (P)	--	--	--	--	10	15	25

SAMLEP1301: Fundamental of Cloud Computing (P) (Minor 1) Curriculum Details

Course pre-requisite:

1. Fundamentals of Computer Systems
2. Operating System Basics
3. Computer Networks (Basic Level)
4. Basic Database Knowledge

Course Objectives:

4. To introduce the fundamental concepts of cloud computing, including cloud models, service types, and the shared responsibility model.
5. To familiarize students with the basics of Microsoft Azure and its core architectural components.
6. To understand various Azure services such as computer, networking, storage, identity, and security.

Course Outcomes:

1. Apply Azure services to create, configure, and manage cloud resources such as virtual machines, storage accounts, and virtual networks.

2. Analyse factors affecting cost in Azure and utilize tools like pricing calculator and cost management for optimization.

Curriculum Details:

List of Practical

1. Demonstrate the Shared Responsibility Model using a diagram.
2. Create an account on Microsoft Azure portal.
3. Create and manage a Resource Group.
4. Create a Virtual Machine (VM) in Azure.
5. Configure VM (CPU, RAM, OS selection).
6. Create and configure Virtual Network (VNet)
7. Create a Storage Account and upload/download files.
8. Working with Blob Storage (upload images/files).
9. Configure access control using IAM (Identity and Access Management).
10. Implement basic security using Network Security Groups (NSG)
11. Analyze billing using Azure Cost Management tool.
12. Create and apply tags to resources.
13. Azure CLI / PowerShell to create resources
14. Deploy resources using Azure Resource Manager (ARM) templates.
15. Create alerts for resource usage..

Text Books:

4. Thomas Erl, Ricardo Puttini, Zaigham Mahmood, “Cloud Computing: Concepts, Technology & Architecture”, First Edition, Pearson, 2013.
5. Anthony Puca, Michael Washam,“Exam Ref AZ-900 Microsoft Azure Fundamentals”, Second Edition, Microsoft Press, 2022.
6. Rajkumar Buyya, James Broberg, Andrzej Goscinski, “Cloud Computing: Principles and Paradigms”, First Edition, Wiley, 2011.

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, “Mastering Cloud Computing”, First Edition, McGraw Hill Education, 2013.

Course Structure:

Vocational Course– Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SAMLVC1301	IOT	--	20	--	02	02

Vocational Course– Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SAMLVC1301	IOT	--	--	--	--	20	30	50

SAMLVC1301: IOT (Vocational Course) Curriculum Details

Course Pre-requisites

1. Basic knowledge of programming using **Python** or any high-level language.

2. Fundamental understanding of mathematics and logical problem-solving concepts.

Course Objectives

1. To introduce fundamental concepts and theoretical foundations of the subject.
2. To develop practical skills for implementing concepts using appropriate tools and techniques.
3. To enable students to apply knowledge to solve real-world problems effectively.

Course Outcomes

After successful completion of the course, students will be able to:

1. Understand and explain key concepts and principles of the subject.
2. Apply appropriate techniques, tools, and methods to solve problems.
3. Design and implement solutions for real-world applications.

Curriculum Details:

List of Practical

1. Controlling the Light Emitting Diode (LED) with a push button.
2. Interfacing the RGB LED with the Arduino
3. Controlling the LED blink rate with the potentiometer interfacing with Arduino
4. Detection of the light using photo resistor
5. Interfacing of temperature sensor LM35 with Arduino
6. Interfacing Servo Motor with the Arduino
7. Interfacing of the Active Buzzer with Arduino
8. Interfacing of the Relay with Arduino
9. Building Intrusion Detection System with Arduino and Ultrasonic Sensor
10. Directional Control of the DC motor using Arduino
11. Interfacing LCD (16x2) display with Arduino and displaying sensor data
12. Interfacing IR Sensor with Arduino for object detection
13. Controlling multiple LEDs using Arduino (Sequential/Pattern control)
14. Interfacing Bluetooth module (HC-05) with Arduino for wireless control
15. Interfacing Soil Moisture Sensor with Arduino for smart irrigation system

Text Books

1. Raj Kamal, *"Internet of Things: Architecture and Design Principles"*, 2nd Edition, McGraw Hill Education, 2017.

2. Arshdeep Bahga and Vijay Madisetti, *"Internet of Things: A Hands-On Approach"*, 1st Edition, Universities Press, 2015.

3. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton and Jerome Henry, *"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things"*, 1st Edition, Cisco Press, 2017.

Reference Books

1. Cuno Pfister, *"Getting Started with the Internet of Things"*, 1st Edition, O'Reilly Media, 2011.
2. Samuel Greengard, *"The Internet of Things"*, 1st Edition, MIT Press, 2015.
3. Srinivasa K. G., *"Internet of Things"*, 1st Edition, Cengage Learning, 2017.

Course Structure:

Project– Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SAMLFP1301	Project	--	30	--	04	04

Project– Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SAMLFP1301	Project	--	--	--	--	40	60	100

SAMLFP1301: Project

Semester IV

Course Structure:

Major 1 – Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SAMLCT1351	Computer Vision and Image Analytics	45	--	03	--	03

Major 1 – Assessment Scheme

Course Code (1)	Course Name (Paper Title) (2)	Theory				Practical		Total [Col (5+6) Or Col (7+8)
		CA			ESA (6)			
		Test I (3)	Test II (4)	Sum of T1 & T2 (5)		CA (7)	ESA (8)	
SAMLCT1351	Computer Vision and Image Analytics	15	15	30	45	--	--	75

SAMLCT1351: Computer Vision and Image Analysis (Major 1) Curriculum Details

Course pre-requisite:

1. To understand Image Processing Fundamentals: Knowledge of filtering, color spaces, geometric transformations, and Fourier transforms is critical.

2. To understand Machine Learning (ML): Basic knowledge of supervised learning and neural networks is necessary to understand modern approaches.

3. To understand Libraries and Frameworks: Familiarity with OpenCV (for computer vision tasks) and numerical computing libraries like NumPy or frameworks like PyTorch/TensorFlow is highly recommended.

Course Objectives:

1. To understand digital image processing principles.

2. To apply image processing techniques and to implement image enhancement and restoration.

3. Perform image segmentation and object detection, & To extract features for analysis and classification. To develop Python applications for image processing tasks.

Course Outcomes:

1. Acquire proficiency in digital image processing fundamentals.
2. Demonstrate competence in utilizing Python for image processing
3. Execute techniques for image enhancement and restoration effectively.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		**INTRODUCTION**	12
	1.1	Overview, Fundamental of image processing	
	1.2	Image formation and sensing, Image acquisition and representation, Image sampling and quantization	
	1.3	Edge detection, Edge detection performance corner detection Otsu's Method, Adaptive Thresholding	
	1.4	Image Enhancement: Histogram Equalization, Smoothing, harpening, Noise Reduction	
2.0		**PRE-PROCESSING**	12
	2.1	Morphological filtering, Fourier transform. Feature extraction, Shape, histogram	
	2.2	Color, spectral, texture, using CVIPtools	
	2.3	Feature analysis, Feature vectors, distance	
	2.4	Similarity measures, Data pre-processing	
3.0		**IMAGE DESCRIPTORS AND FEATURES**	08
	3.1	Texture Descriptors, Colour Features, Edges Boundaries	
	3.2	Object Boundary, Shape Representations, Interest, Corner Point Detectors	
	3.3	Speeded up Robust Features, Saliency.	
	3.4	Descriptors: Boundary, Fourier, Regional, Descriptors – Topological	
4.0		**OBJECT DETECTION AND RECOGNITION.**	13
	4.1	Descriptors - moment invariants	
	4.2	Object detection and recognition in image	
	4.3	video: Minimum distance classifier, K-NN classifier and Bayes,	
	4.4	Applications in image and video analysis, object tracking in videos. Object detection algorithms.	
			45

Text Books:

1. Gonzalez, R.C., Woods, R.E., & Eddins, S.L. (2018). Digital Image Processing Using MATLAB.
2. M.K. Bhuyan, " Computer Vision and Image Processing: Fundamentals and Applications", CRC Press, USA, Ed-4, 2017.
3. Richard Szeliski, "Computer Vision- Algorithms & Applications", Springer. Ed-3, 2018

Reference Books:

1. Burger, W., & Burge, M.J. (2016). Digital Image Processing: An Algorithmic Approach with MATLAB.
2. Sonka, M., Hlavac, V., & Boyle, R. (2014). Image Processing, Analysis, and Machine Vision.
3. Dictionary of Computer Vision and Image Processing, by Fisher et al. Springer, Ed2, 2015.
4. Milan Sonka, Vaclav Hlavac, and Roger Boyle, "Image Processing, Analysis, and Machine Vision", Cengage Learning.

Course Structure:

Major 2 – Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SAMLCT1352	Deep Learning	45	--	03	--	03

Major 2 – Assessment Scheme

Course Code (1)	Course Name (Paper Title) (2)	Theory				Practical		Total [Col (5+6) Or Col (7+8)]
		CA			ESA (6)			
		Test I (3)	Test II (4)	Sum of T1 & T2 (5)		CA (7)	ESA (8)	
SAMLCT1352	Deep Learning	15	15	30	45	--	--	75

SAMLCT1352: Deep Learning (Major 2) Curriculum Details

Course pre-requisite:

1. **Programming Skills:** Basic proficiency in **Python**, including working with libraries and writing structured programs.
2. **Mathematics Foundation :** Understanding of: Linear Algebra (vectors, matrices, eigenvalues) Calculus (derivatives, partial derivatives) , Probability & Statistics (distributions, mean, variance)
3. **Machine Learning Basics:** Familiarity with concepts from **Machine Learning**, such as supervised/unsupervised learning, regression, classification, and overfitting.
4. **Basic Neural Network Concepts :** Introductory knowledge of perceptron, activation functions, and simple neural networks.

Course Objectives:

1. Introduce the fundamental concepts and architecture of deep neural networks.
2. Students will develop an understanding of key algorithms such as forward propagation and backpropagation.
3. Students will explore different deep learning models including Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs).
4. Enable students to implement deep learning models using frameworks like TensorFlow and Keras.
5. Apply deep learning techniques to solve real-world problems in image processing, speech recognition, and natural language processing.

6. Evaluate model performance and optimize deep learning models using appropriate techniques.
7. Understand recent advancements such as transfer learning and transformers.
8. Develop the ability to design and build end-to-end deep learning applications.

Course Outcomes:

1. CO1: Apply backpropagation to optimize neural networks, showcasing proficiency in foundational deep learning concepts.
2. CO2: Design effective image processing models using CNNs and advanced architectures for computer vision tasks.
3. CO3: Utilize attention mechanisms and sequence-based learning for NLP, demonstrating competency in language understanding.
4. CO4: Implement Unsupervised and Semi-Supervised Deep Learning techniques to discover meaningful patterns in data.
5. CO5: Apply advanced deep learning techniques, for cutting-edge applications and responsible AI practices.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		**Foundations of Deep Learning**	
	1.1	Neural Networks: Perceptrons, Multi-Layer Perceptrons (MLPs), Topology of neural networks, Backpropagation algorithm.	
	1.2	Introduction to Deep Learning: Overview of deep learning concepts, applications, and current trends.	
	1.3	Optimization Techniques: Gradient Descent, Stochastic Gradient Descent (SGD), Adam, and other optimizers.	
	1.4	Regularization Techniques: Dropout, L1/L2 Regularization, Early Stopping.	
	1.5	Loss Functions: Cross-Entropy, Mean Squared Error (MSE), Hinge Loss, and other relevant losses.	
2.0		**Deep Learning for Computer Vision**	
	2.1	Convolutional Neural Networks (CNNs): Architecture, filters, feature maps, pooling layers.	
	2.2	Advanced CNN Architectures: LeNet, AlexNet, VGGNet, ResNet, DenseNet, EfficientNet.	
	2.3	Object Detection: R-CNN, Fast R-CNN,	

		Faster R-CNN, YOLO, SSD.	
	2.4	Segmentation: FCN, U-Net.	
	2.5	Generative Models: Variational Autoencoders (VAEs), Generative Adversarial Networks (GANs).	
3.0		**Deep Learning for Natural Language Processing**	
	3.1	Recurrent Neural Networks (RNNs): LSTM, GRU, and their applications.	
	3.2	Sequence-to-Sequence Models: Machine Translation, Text Summarization.	
	3.3	Attention Mechanisms: Transformer architectures, BERT, GPT, T5.	
	3.4	Text Generation, Machine Translation, Sentiment Analysis	
4.0		**Unsupervised and Semi-Supervised Deep Learning**	
	4.1	Autoencoders and Denoising Autoencoders.	
	4.2	Self-Supervised Learning: Contrastive Learning, Momentum Contrast (MoCo).	
	4.3	Representation Learning: Dimensionality reduction, manifold learning.	
	4.4	Clustering with Deep Learning: Deep Embedded Clustering (DEC), Variational Deep Embedding (VaDE).	
		Total	

Text Books:

1. Aaron Courville, Ian Goodfellow, Yoshua Bengio(2020), Deep Learning (Adaptive Computation and Machine Learning series)(3rd ed.), MIT Press.
2. Rajalingappaa Shanmugamani (2018). Deep Learning for Computer Vision(1st ed.), Packt Publishing.

Reference Books:

1. Richard S. Sutton, Andrew G. Barto, Francis, Bach (2018), Reinforcement Learning: An Introduction(1st ed.), MIT Press2.
2. Denis Rothman (2020), Hands-On Explainable AI (XAI) with Python(1st ed.), Packt Publishing Limited.
3. Aaron Courville, Ian Goodfellow, Yoshua Bengio(2020), Deep Learning (Adaptive Computation and Machine Learning series)(3rd ed.), MIT Press.

Course Structure:

Major 3 – Teaching Scheme

Course Code	**Course Name (Paper Title)**	**Teaching Scheme(Hrs.)**		**Credits Assigned**		
		Theory	**Practical**	**Theory**	**Practical**	**Total**
SAMLCT1353	AI in Robotics and Automation	30	--	02	--	02

Major 3 – Assessment Scheme

Course Code (1)	**Course Name (Paper Title) (2)**	**Theory**				**Practical**		**Total [Col (5+6) Or Col (7+8)**
		CA			**ESA (6)**			
		Test I (3)	**Test II (4)**	**Sum of T1 & T2 (5)**		**CA (7)**	**ESA (8)**	
SAMLCT1353	AI in Robotics and Automation	10	10	20	30	--	--	50

SAMLCT1353: AI in Robotics and Automation (Major 3) Curriculum Details

Course pre-requisite:

1. Basics of Programming (Python/C/C++)
2. Fundamentals of Mathematics
3. Basic Electronics & Sensors
4. Introductory AI & Machine Learning

Course Objectives:

1. Understand AI and Robotics fundamentals
2. Apply AI techniques in robotic systems
3. Design intelligent automation systems
4. Develop AI-based robotic applications

Course Outcomes:

1. Understand AI concepts in robotics
2. Apply machine learning techniques
3. Analyze perception and control systems
4. Build simple automation solutions

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		**Introduction to AI and Robotics**	12
	1.1	Basics of Artificial Intelligence	
	1.2	Types of Robots (Industrial, Service, Mobile)	
	1.3	Components (Sensors, Actuators, Controllers)	
	1.4	Role of AI in Robotics	
2.0		**Machine Learning for Robotics**	11
	2.1	Supervised & Unsupervised Learning	
	2.2	Reinforcement Learning	
	2.3	Neural Networks Basics	
	2.4	Applications in Robotics	
3.0		**Robot Perception & Vision**	11
	3.1	Image Processing Basics	
	3.2	Object Detection & Recognition	
	3.3	Sensor Fusion	
	3.4	Localization & Mapping (SLAM)	
4.0		**Automation, Planning & Applications**	11
	4.1	Path Planning Algorithms	
	4.2	Motion & Control Systems	
	4.3	Industrial Automation (PLC, IoT)	
	4.4	Applications (Healthcare, Agriculture, Defense)	
		Total	**45**

Text Books:

1. Stuart Russell & Peter Norvig – *Artificial Intelligence: A Modern Approach*
2. Siciliano & Khatib – *Handbook of Robotics*

Reference Books:

1. Szeliski – *Computer Vision: Algorithms and Applications*
2. Goodfellow et al. – *Deep Learning*

Course Structure:

Major 1 – Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SAMLCP1354	Computer Vision and Image Analysis (P)	--	20	--	02	02

Major 1 – Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SAMLCP1354	Computer Vision and Image Analysis (P)	--	--	--	--	20	30	50

SAMLCP1354: Computer Vision and Image Analysis (P) Curriculum Details

Course pre-requisite:

1. To understand Image Processing Fundamentals: Knowledge of filtering, color spaces, geometric transformations, and Fourier transforms is critical.

2. To understand Machine Learning (ML): Basic knowledge of supervised learning and neural networks is necessary to understand modern approaches.

3. To understand Libraries and Frameworks: Familiarity with OpenCV (for computer vision tasks) and numerical computing libraries like NumPy or frameworks like PyTorch/TensorFlow is highly recommended.

Course Objectives:

1. To understand digital image processing principles.
2. To apply image processing techniques and to implement image enhancement and restoration.
3. Perform image segmentation and object detection, & To extract features for analysis and classification. To develop Python applications for image processing tasks.

Course Outcomes:

1. Acquire proficiency in digital image processing fundamentals.
2. Demonstrate competence in utilizing Python for image processing
3. Execute techniques for image enhancement and restoration effectively.

Curriculum Details:

List of Practical

1. **Program to perform Resize and Rotation** of binary, grayscale, and color images using various interpolation methods (nearest, bilinear, bicubic).
2. **Program to implement Contrast Stretching** for image enhancement.
3. **Program to implement various Image Enhancement Techniques** using built-in and user-defined functions (histogram equalization, smoothing, sharpening).
4. **Program to implement Non-linear Spatial Filtering** (median filter, max/min filter).
5. **Program to implement Homomorphic Filtering** for illumination correction.
6. **Extraction of Frames from Videos** and basic frame analysis (grayscale conversion, histogram).
7. **Extract Feature Descriptors** (SIFT, SURF, ORB) from an image dataset.
8. **Implement Image Classification** using extracted features (e.g., KNN, SVM).
9. **Program to perform Edge Detection** using operators like Sobel, Prewitt, and Canny.
10. **Program for Image Thresholding and Segmentation** (global, adaptive, Otsu's method).
11. **Program to perform Morphological Operations** (erosion, dilation, opening, closing).
12. **Program to implement Image Segmentation using Clustering** (K-means clustering).
13. **Program for Object Detection using Pre-trained Models** (e.g., Haar Cascade or YOLO basic implementation).
14. **Program for Face Detection and Recognition** using OpenCV.
15. **Program for Optical Flow or Motion Detection** in video sequences.

Text Books:

4. Gonzalez, R.C., Woods, R.E., & Eddins, S.L. (2018). Digital Image Processing Using MATLAB.
5. M.K. Bhuyan, " Computer Vision and Image Processing: Fundamentals and Applications", CRC Press, USA, Ed-4, 2017.
6. Richard Szeliski, "Computer Vision- Algorithms & Applications", Springer. Ed-3, 2018

Reference Books:

5. Burger, W., & Burge, M.J. (2016). Digital Image Processing: An Algorithmic Approach with MATLAB.
6. Sonka, M., Hlavac, V., & Boyle, R. (2014). Image Processing, Analysis, and Machine Vision.

7. Dictionary of Computer Vision and Image Processing, by Fisher et al. Springer, Ed2, 2015.
8. Milan Sonka, Vaclav Hlavac, and Roger Boyle, "Image Processing, Analysis, and Machine Vision", Cengage Learning.

Course Structure:

Major 2 – Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SAMLCP1355	Deep Learning (P)	--	20	--	02	02

Major 2 – Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SAMLCP1355	Deep Learning (P)	--	--	--	--	20	30	50

SAMLCP1355: Deep Learning (P) Curriculum Details

Course pre-requisite:

1. Programming Skills
2. Mathematics Fundamentals
3. Basics of Machine Learning

Course Objectives:

1. To introduce the fundamental concepts of Deep Learning, including its evolution from Artificial Intelligence and Machine Learning.
2. To understand the structure and functioning of artificial neural networks, including perceptron models and their limitations.
3. To study various components of neural networks such as activation functions, loss functions, and optimization techniques.

Course Outcomes:

1. Apply training techniques such as gradient descent and back propagation to build and train neural network models..

2 Analyse issues like over fitting and under fitting and apply regularization and optimization techniques to improve model performance.

Curriculum Details:

List of Practical

1. Python & NumPy Refresher.
2. Implement Perceptron from Scratch.
3. Multi-Layer Neural Network using NumPy
4. Neural Network using High-Level Libraries
5. Activation & Loss Functions Analysis.
6. Implementing Optimization Algorithms.
7. Implementing Regularization Techniques
8. CNN for Image Classification.
9. CNN Architecture Comparison.
10. Transfer Learning

Text Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, First Edition, MIT Press, 2016.2. Tom White, “Hadoop: The Definitive Guide”, Fourth Edition, O'Reilly Media, 2015.
2. François Chollet, “Deep Learning with Python”, Second Edition, Manning Publications, 2021.

Reference Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, First Edition, MIT Press, 2016.2. Tom White, “Hadoop: The Definitive Guide”, Fourth Edition, O'Reilly Media, 2015.
3. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow”, Second Edition, O'Reilly Media, 2019.

Course Structure:

Minor 1 -Teaching Scheme

Course Code	**Course Name (Paper Title)**	**Teaching Scheme(Hrs.)**		**Credits Assigned**		
		Theory	**Practical**	**Theory**	**Practical**	**Total**
SAMLET1351	Feature Engineering	45	--	03	--	03

Minor 1–Assessment Scheme

Course Code (1)	**Course Name (Paper Title) (2)**	**Theory**				**Practical**		**Total [Col (5+6) Or Col (7+8)**
		CA			**ESA (6)**			
		Test I (3)	**Test II (4)**	**Sum of T1 & T2 (5)**		**CA (7)**	**ESA (8)**	
SAMLET1351	Feature Engineering	15	15	30	45	--	--	75

SAMLET1351: Feature Engineering (Minor 1) Curriculum Details

Course pre-requisite:

1. Basic knowledge of **Python programming**
2. Understanding of **Statistics (mean, variance, probability)**
3. Basics of **Machine Learning concepts**
4. Familiarity with libraries like NumPy, Pandas

Course Objectives:

1. To understand the importance of feature engineering in machine learning
2. To learn techniques for data preprocessing and feature transformation
3. To apply feature selection and extraction methods
4. To build better ML models using optimized features

Course Outcomes:

1. Identify and preprocess different types of data features
2. Apply feature transformation and encoding techniques
3. Perform feature selection and dimensionality reduction
4. Improve model performance using effective feature engineering

Curriculum Details:

Module No.	Unit No.	Topic	Hrs. Required to cover the contents
1.0		**Introduction to Feature Engineering**	10
	1.1	What is feature engineering	
	1.2	Types of data (numerical, categorical, text, image)	
	1.3	Importance in machine learning pipeline	
	1.4	Data cleaning and preprocessing basics	
2.0		**Data Preprocessing & Transformation**	12
	2.1	Handling missing values	
	2.2	Data normalization and standardization	
	2.3	Encoding techniques: • Label Encoding • One-Hot Encoding	
	2.4	Feature scaling methods	
3.0		**Feature Extraction Techniques**	12
	3.1	Feature construction	
	3.2	Text feature extraction (Bag of Words, TF-IDF)	
	3.3	Image feature basics	
	3.4	Time-series feature extraction	
4.0		**Feature Selection & Dimensionality Reduction**	11
	4.1	Filter methods (correlation, chi-square)	
	4.2	Wrapper methods (forward/backward selection)	
	4.3	Embedded methods (Lasso, Ridge)	
	4.4	Dimensionality reduction: PCA (Principal Component Analysis) Feature importance techniques	
		Total	**45**

Text Books:

1. Alice Zheng & Amanda Casari – *Feature Engineering for Machine Learning*
2. Aurélien Géron – *Hands-On Machine Learning with Scikit-Learn & TensorFlow*

Reference Books:

1. Kuhn & Johnson – *Feature Engineering and Selection*
2. Bishop, C.M. – *Pattern Recognition and Machine Learning*
3. Jason Brownlee – *Machine Learning Mastery Series*

Course Structure:

Minor 1-Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SAMLEP1351	Feature Engineering (P)	--	10	--	01	01

Minor 1–Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SAMLEP1351	Feature Engineering (P)	--	--	--	--	10	15	25

SAMLEP1351: Feature Engineering (P) Minor 1 Curriculum Details

Course pre-requisite:

1. Basic knowledge of Python programming
2. Understanding of Statistics (mean, median, variance, probability)
3. Fundamentals of Machine Learning
4. Familiarity with NumPy, Pandas, Matplotlib

Objectives:

1. To understand the role of feature engineering in machine learning
2. To learn data preprocessing and transformation techniques
3. To apply feature extraction and selection methods
4. To improve model performance using engineered features

Course Outcomes:

1. Preprocess and clean raw data effectively
2. Apply feature transformation and encoding techniques
3. Perform feature selection and dimensionality reduction
4. Build better ML models using optimized features

Curriculum Details:

List of Practical

1. Load dataset using Pandas and perform basic data exploration
2. Handle missing values using mean, median, mode
3. Detect and treat outliers using statistical methods
4. Perform data normalization and standardization
5. Apply Label Encoding on categorical data
6. Apply One-Hot Encoding on dataset
7. Create new features from existing data (feature construction)
8. Extract date-time features (year, month, day)
9. Perform text feature extraction using Bag of Words
10. Apply TF-IDF for text data
11. Perform correlation analysis for feature selection
12. Apply chi-square test for feature selection
13. Implement PCA for dimensionality reduction
14. Compare model performance before and after feature engineering
15. Mini Project: Apply complete feature engineering pipeline on dataset

Text Books:

1. Alice Zheng & Amanda Casari – *Feature Engineering for Machine Learning*
2. Aurélien Géron – *Hands-On Machine Learning with Scikit-Learn & TensorFlow*

Reference Books:

1. Kuhn & Johnson – *Feature Engineering and Selection*
2. *Bishop, C.M. – Pattern Recognition and Machine Learning*
3. *Jason Brownlee – Machine Learning Mastery Series*

Course Structure:

Vocational Course– Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SAMLVC1351	Prompt Engineering	--	20	--	02	02

Vocational Course– Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SAMLVC1351	Prompt Engineering	--	--	--	--	20	30	50

SAMLVC1351: Prompt Engineering (Vocational Course) Curriculum Details

Course pre-requisite:

1. Basic knowledge of computers and internet
2. Fundamentals of Artificial Intelligence and Machine Learning
3. Basic understanding of programming (optional)
4. Basic English communication skills

Course Objectives:

1. To introduce the fundamentals of prompt engineering and AI interaction
2. To understand different types of prompts and their applications
3. To develop skills in designing effective and optimized prompts
4. To apply prompt engineering techniques in real-world tasks

Course Outcomes:

1. Design and create effective prompts for AI systems
2. Analyze and improve AI-generated responses
3. Apply prompt engineering techniques for automation and problem-solving
4. Demonstrate practical skills using AI tools for various applications

Curriculum Details:

List of Practical

1. Demonstrate basic interaction with AI tools (ChatGPT, Gemini, etc.)
2. Write simple prompts for question-answering tasks
3. Perform Zero-shot prompting for general queries
4. Perform Few-shot prompting with examples
5. Implement Role-based prompting (e.g., “Act as a teacher”)
6. Use Chain-of-Thought prompting for step-by-step reasoning
7. Generate text content (essay, email, blog writing) using prompts
8. Create prompts for summarization of long text
9. Generate programming code using prompts
10. Debug and refine prompts for improved output
11. Apply constraints in prompts (length, format, tone)
12. Compare outputs using different prompt styles
13. Generate images using AI prompt tools (basic level)
14. Explore ethical issues and bias in prompt outputs
15. Mini project: Develop a real-world application using prompt engineering

Text Books:

1. Brown, T. et al., Language Models are Few-Shot Learners, OpenAI Research Paper
2. O’Reilly Media, Prompt Engineering for Generative AI (Latest Edition)

Reference Books:

1. Andrew Ng, Generative AI and Prompt Engineering (Online Course Material)
2. OpenAI Documentation – Prompt Design Guidelines
3. DeepLearning.AI Resources on Prompt Engineering

Course Structure:

Project– Teaching Scheme

Course Code	Course Name (Paper Title)	Teaching Scheme(Hrs.)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
SAMLOJ1351	OJT	--	60	--	04	04

Project– Assessment Scheme

Course Code	Course Name (Paper Title)	Theory				Practical		Total
		CA			ESA			
		Test I	Test II	Sum of T1 & T2		CA	ESA	
SAMLOJ1351	OJT	--	--	--	--	40	60	100

SAMLOJ1351: OJT

Paper Format for 45 Marks

Time: 2:30 Hour **Marks :45**

Note:

I Q.1 is compulsory.

II Solve any 2 Questions from Question number 2 to 5.

III Figures to the Right indicates Full Marks.

IV Assume suitable data whenever necessary.

Q.1 Attempt the following. (on all 4 Units) **15**

a)

b)

c)

d)

e)

Q. 2 Attempt the following. (on First Unit) **15**

a)

b)

c)

Q. 3 Answer the following. (on Second Unit) **15**

a)

b)

c)

Q. 4 Attempt the following. (on Third Unit) **15**

a)

b)

c)

Q .5 Write short note on. (on Forth Unit) **15**

a)

b)

c)

***

Paper Format for 30 Marks

Time: 2:00 Hour **Marks :30**

Note:

I Q.1 is compulsory.

II Solve any 2 Questions from Question number 2 to 5.

III Figures to the Right indicates Full Marks.

IV Assume suitable data whenever necessary.

Q.1 Attempt the following. (on all 4 Units) **10**

a)

b)

c)

d)

Q. 2 Attempt the following. (on First Unit) **10**

a)

b)

Q. 3 Answer the following. (on Second Unit) **10**

a)

b)

Q. 4 Attempt the following. (on Third Unit) **10**

a)

b)

Q .5 Write short note on. (on Forth Unit) **10**

a)

b)

***