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Modules	**Topic No.**	**Topic Names**	**Teaching Hours**	**Week Wise Schedule**
Introduction to Data Science	1.1	Introduction to Data Science		
	1.2	Discussion on Course Curriculum		
	1.3	Introduction to Programming		
Python - Basics	2.1	Introduction to Python: Installation and Running (Jupyter Notebook, .py file from terminal, Google Colab)		
	2.2	Data types and type conversion		
	2.3	Variables		
	2.4	Flow Control : If, Elif, Else		
	2.5	Loops		
Python - Data Types & Utilities	3.1	List, List of Lists and List Comprehension		
	3.2	Set and Tuple		
	3.3	Dictionary and Dictionary comprehension		
	3.4	Functions		
	3.5	Map Reduce		
	3.6	Decorator		
Python - Production Level	4.1	Error / Exception Handling		
	4.2	File Handling		
	4.3	Docstrings		
	4.4	Modularization		
SQL	5.1	Basics of DBMS		
	5.2	Basics of SQL		
	5.3	SELECT WHERE Statements		
	5.4	JOINS		
	5.5	GROUP BY and ORDER BY		
	5.6	PARTITION BY		
Mathematics Basics	6.1	Derivative as slope of a curve,optimality conditions		
	6.2	Integration as area under the curve		
	6.3	Matrix Algebra: Vector Matrix Vector matrix multiplication Matrix matrix multiplication Eigen Values and Eigen Vectors		
Python Essential Packages	7.1	NumPy		
	7.2	Pandas		

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Modules	**Topic No.**	**Topic Names**	**Teaching Hours**	**Week Wise Schedule**
	7.3	Data Visualization Library: Matplotlib, Seaborn		
Statistics Basics	8.1	Descriptive Statistics: Central Tendency		
	8.2	Variance, Standard Deviation		
	8.3	Covariance		
	8.4	Perason's and Spearman Correlation Coefficients		
	8.5	Correlation vs. Causation		
	8.6	Different types of Plots for Continuous, Categorical variable		
Probability Theory	9.1	Basic Count based Probability		
	9.2	Conditional Probability		
	9.3	Bayes Rule		
	9.4	Probability Distribution: Discrete and Continuous		
	9.5	Normal Distribution		
	9.6	Bernouli and Binomial Distribution		
Statistics Advanced	10.1	Population and Sample		
	10.2	Sampling Distribution and Central Limit Theorem		
	10.3	Standard Error		
	10.4	Confidence Interval		
	10.5	Hypothesis testing: One tail,Two tail and p-value		
	10.6	Z-test, t-test		
Visualization using Power BI	11.1	How to use Power BI		
	11.2	Basics of Power BI		
	11.3	Creating Visualization using Power BI		
Exploratory Data Analysis	12.1	Introduction one, two practical dataset		
	12.2	Missing values treatment		
	12.3	Outlier detection and treatment		
	12.4	Plotting (univariate, bi-variate)		
	12.5	Column Standardization		
	12.6	Treating Categorical Variable		
	12.7	Understanding Feature Importance conceptually		

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Modules	**Topic No.**	**Topic Names**	**Teaching Hours**	**Week Wise Schedule**
Machine Learning Fundamentals	13.1	Types of Machine Learning Methods		
	13.2	Classification problem in general		
	13.3	Validation Techniques: CV,OOB		
	13.4	Different types of metrics for Classification		
	13.5	Curse of dimensionality		
	13.6	Feature Transformations		
	13.7	Feature Selection		
	13.8	Imabalnced Dataset and its effect on Classification		
	13.9	Bias Variance Tradeoff		
	13.1	Overfitting vs Underfitting vs Normal fitting		
Supervised Machine Learning Part 1	14.1	Linear Regression and It's assumptions		
	14.2	L1 L2 Regularization		
	14.3	Forward and Backward selection methods		
	14.3	Logistic Regression		
	14.4	k-Nearest Neighbour classifier		
	14.5	Naive Bayes classifier		
	14.6	Decision Tree		
	14.7	Support Vector Machine		
Mini Project	14.8	Mini Project 1		
Supervised Machine Learning Part 2	15.1	Ensemble: Bagging		
	15.2	Random Forest Regressor and Classifier		
	15.3	Ensemble: Boosting		
	15.4	Gradient Boosting: AdaBoost		
	15.5	XGBoost		
	15.6	Gradient Descent technqiue		
	15.7	Creating your own Ensemble Classifier		
	15.8	Non Matrix Factorization		
	15.9	Recommendation Engine		
Mini Project	15.1	Mini Project 2		
Unsupervised Learning Part 1	16.1	Basics of Clustering: Clustering Metrics, applications		
	16.2	K Means Algorithm		
	16.3	Density Based Clustering DBSCAN		
	16.4	Hierarchical Clustering: Agglomerative		

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Modules	**Topic No.**	**Topic Names**	**Teaching Hours**	**Week Wise Schedule**
	16.5	Market Basket Analysis		
	16.6	Unsupervised metrics		
Unsupervised Learning Part-2	17.1	Mathematical Prerequisite: Constraint Optimization Covariance Matrix Matrix Calculus		
	17.2	Principal Component Analysis		
	17.3	Singualr Value Decomposition		
Mini Project	17.4	Mini Project 3		
Deep Learning Part 1	18.1	Biological and Artificial Neuron		
	18.2	Perceptron and its learning rule and drawbacks		
	18.3	Multilayer Perceptron, loss function		
	18.4	Activation Functions		
	18.5	Training MLP: Backpropagation		
	18.6	Introduction to Tensorflow and Keras		
	18.7	Vanishing and Exploding Gradient Problem		
Deep Learning Part 2	19.1	Regularization		
	19.2	Optmizers		
	19.3	Hyperparameters and tuning of the same		
Basics of Image Processing	20.1	Images as matrix		
	20.2	Histogram of images		
	20.3	Basic filters applied on the images		
Deep Learning Part 3	21.1	Convolutional Neural Networks (CNN)		
	21.2	ImageNet Dataset		
	21.3	Project: Image Classification		
	21.4	Different types of CNN architectures		
	21.5	Recurrent Neural Network (RNN)		
	21.6	Using pre-trained model: Transfer Learning		
Basic Natural Language Processing	22.1	Texts, Tokens		
	22.2	Bag of Words		
	22.3	Basic text classification based on Bag of Words		
	22.4	n-gram: Unigram, Bigram		
	22.5	Word vectorizer basics, One Hot Encoding		
Intermediate Natural Language Processing	23.1	Count Vectorizer		
	23.2	Word cloud and gensim		
	23.3	TF-IDF Vectorizer		
	23.4	Word2Vec and Glove		

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Modules	**Topic No.**	**Topic Names**	**Teaching Hours**	**Week Wise Schedule**
	23.5	Text classification using Word2Vec and Glove		
Mini Project	23.6	Mini Project 4		
Deep Learning - Part 4	24.1	Recurrent Neural Network (RNN)		
	24.2	Back Propagation through time		
	24.3	Different types of RNN: LSTM, GRU		
	24.4	Biirectional RNN		
	24.5	Seq 2 Seq model (Encoder Decoder)		
	24.6	BERT Transformers		
	24.7	Text generation and classification using Deep Learning		
	24.8	Generative-AI (Chat-GPT)		
Time Series and Forecasting	25.1	Different Components of Time Series		
	25.2	Statistical Models of time series forecasting AR MA ARMA ARIMA		
	25.3	Time Series Forecasting using Statsmodel library		
	25.4	Time Series Forecasting using Deep Learning		
Capstone Project & Presentation	26.1	Project Discussion		
	26.2	Presentation		
Mlops	27.1	Mlflow		
	27.2	Azure Machine learning		
Generative AI	27.1	Chat GPT		
	27.2	LLM models		

Note: All conecepts Theory with Mathamatics and Practical with Python Programming language