

Government of Pakistan

National Vocational and Technical Training Commission

Prime Minister's Youth Skills Development Program



Course Contents / Lesson Plan

Course Title: Comprehensive Course in AI, Data Science, Data Mining, and Block chain Technologies

Duration: 6 Months

Trainer Name	
Author	Mr.Muzammil Hassan (Manager Research KICS UET Lahore)
Course Title	Integrated Solutions: Comprehensive Course in AI, Data Science, Data Mining, and Block chain Technologies
Objectives and Expectations	<p>This specialized program has been meticulously developed to meet the growing demand for proficient individuals in Oracle Java, Angular, AI, Blockchain, Data Science, and soft skills. It focuses on enhancing employability by providing hands-on practice and practical expertise. The primary objective is to transcend theoretical knowledge and empower participants with the capabilities to thrive in the job market, whether working independently or collaboratively within a team.</p> <p>The curriculum is strategically designed to impart not only technical proficiency in AI, and Blockchain, but also emphasizes the importance of soft skills, including interpersonal communication, personal presentation, and entrepreneurial skills such as marketing and freelancing. Additionally, the program strives to cultivate a strong work ethic, promoting exemplary professional conduct to elevate the reputation of the Pakistani workforce in the domains of AI, Blockchain, Data Science, and soft skills</p> <p>Main Expectations:</p> <p>The primary expectation is that, guided by experienced professionals, participants will develop proficiency in applying skills related to AI, Data Science, Blockchain, and Soft Skills to secure income upon completion. This approach is grounded in a market-centric strategy, necessitating instructors to grasp industry roles, evaluate individual strengths and weaknesses, and effectively prepare participants for relevant positions in the realms of AI, Data Science, Blockchain, and Soft Skills.</p> <p>Implementation:</p> <p>Specially designed practical tasks related to AI, Data Science, Blockchain, and Soft Skills are included in Annexure-I, with records maintained for monitoring visits.</p>

	<p>A dedicated module on Job Search & Entrepreneurial Skills addresses local and international job markets, visa processes, and opportunities for self-employment.</p> <p>A module on Workplace Ethics emphasizes positive behavior in professional settings, contributing to an enhanced image of the Pakistani workforce.</p> <p>Maintaining Interest: To keep participants motivated, modern techniques like motivational lectures, success stories, and case studies are employed. These tools, detailed in the training methodology, aim to sustain interest and objectively assess acquired competencies.</p> <ul style="list-style-type: none"> (i) Motivational Lectures: (ii) Motivational lectures, a crucial component, aim to inspire participants towards professional excellence in AI, Data Science, Blockchain, and Soft Skills. These lectures include a clear purpose, personal stories, participant relevance, and compelling ending points to drive creativity and curiosity. (iii) Success Stories: (iv) Success stories, shared through various mediums, motivate participants by showcasing the journey to success in AI, Data Science, Blockchain, and Soft Skills. The training institute is expected to regularly present high-quality success stories. <p>(iii) Case Studies:</p> <p>Where suitable, case studies enhance understanding by presenting real-life scenarios in AI, Data Science, Blockchain, and Soft Skills. This method encourages participants to actively analyze and discuss practical challenges related to AI, Data Science, Blockchain, and Soft Skills.</p> <p>The ultimate objective is to not only impart technical knowledge but also transform participants into responsible and skilled professionals ready to excel in the AI, Data Science, Blockchain, and Soft Skills job market.</p>
<p>Entry-level of trainees</p>	<p>The eligibility criteria for this 6-month training program on AI, Data Science, and Blockchain is as under:</p> <ul style="list-style-type: none"> • Bachelor's degree* in a relevant field like Computer Science, Software Engineering, Information Technology, Cyber Security, Mathematics, statistics, engineering or technology can apply, subject to clearance of entry test.

	<p>*Students enrolled in 5th semester and onwards are also eligible to apply.</p>
<p>Learning Outcomes of the course</p>	<ul style="list-style-type: none"> • Upon completion of the AI, Data Mining, Data Science, Blockchain, and Soft Skills course, participants will emerge with advanced skills in relevant technologies, enabling them to design and develop sophisticated applications in their respective domains. • Participants will acquire practical experience through real-world projects, building a diverse portfolio that showcases their proficiency in AI, Data Mining, Data Science, Blockchain, and Soft Skills. • Overall, the course equips participants with the knowledge and skills necessary for making impactful contributions to projects in the fields of AI, Data Mining, Data Science, Blockchain, and Soft Skills within various industries.
<p>Course Execution Plan</p>	<p>The total duration of the course: 6 months (24 Weeks)</p> <p>Class hours: 4 hours per day</p> <p>Theory: 20%</p> <p>Practical: 80%</p> <p>Weekly hours: 20 hours per week</p> <p>Total contact hours: 480 hours</p>
<p>Companies offering jobs in the respective trade</p>	<ul style="list-style-type: none"> • Deloitte: Deloitte is a multinational professional services network that offers audit, consulting, financial advisory, risk management, tax, and related services to clients. They are currently hiring for data science roles. • PwC: PwC is a multinational professional services network that provides audit, assurance, consulting, legal, and tax services. They are currently hiring for data science roles. • Amazon and AWS: Amazon is an American multinational technology company that focuses on e-commerce, cloud computing, digital streaming, and artificial intelligence. They are currently hiring for data science roles¹. • EY: EY is a multinational professional services firm that provides assurance, consulting, strategy, and transaction services. They are currently hiring for data science roles. • You can also check out the following websites for more information on companies that are hiring for AI, blockchain, and data science roles:

	<ul style="list-style-type: none"> • Built In: Built In is a platform that connects job seekers with tech companies. They have a list of companies that are hiring for blockchain and data science roles. • AI Jobs: AI Jobs is a job board that lists remote-first companies or employers with primarily distributed teams currently hiring for AI, ML, Data Science roles in Artificial Intelligence (AI), Machine Learning (ML), Natural Language Processing (NLP), Computer Vision (CV), Data Engineering, Data Analytics, Big Data, and Data Science in general. • Datamation: Datamation is a website that provides news and analysis on enterprise IT. They have a list of the top 50 companies hiring for data science roles. • Reclaim: Reclaim is a platform that helps job seekers find jobs at startups and enterprises. They have a list of the top 15 AI companies hiring in 20234
Job Opportunities	<p>AI Jobs:</p> <p>Pakistan: AI Researcher, Machine Learning Engineer, Data Scientist, AI Consultant.</p> <p>USA: AI/ML Specialist, Natural Language Processing Engineer, Computer Vision Scientist.</p> <p>Gulf: AI Developer, Robotics Engineer, AI Solutions Architect.</p> <p>Europe: AI Analyst, Deep Learning Engineer, AI Project Manager.</p> <p>Data Mining Jobs:</p> <p>Pakistan: Data Mining Specialist, Business Intelligence Analyst, Data Analyst.</p> <p>USA: Data Mining Engineer, Database Analyst, Data Scientist.</p> <p>Gulf: Data Mining Consultant, Big Data Analyst, Data Mining Researcher.</p> <p>Europe: Data Mining Specialist, Predictive Modeler, Data Mining Manager.</p> <p>Data Science Jobs:</p> <p>Pakistan: Data Scientist, Data Analyst, Business Intelligence Developer.</p> <p>USA: Data Scientist, Data Engineer, Statistician.</p> <p>Gulf: Data Science Consultant, Data Analyst, Machine Learning Specialist.</p>

	<p>Europe: Data Science Manager, Data Scientist, Data Analytics Specialist.</p> <p>Blockchain Jobs:</p> <p>Pakistan: Blockchain Developer, Smart Contract Developer, Blockchain Consultant.</p> <p>USA: Blockchain Engineer, Cryptocurrency Analyst, Blockchain Solutions Architect.</p> <p>Gulf: Blockchain Developer, Blockchain Project Manager, Cryptography Specialist.</p> <p>Europe: Blockchain Consultant, Blockchain Developer, Blockchain Analyst.</p>
No of Students	25
Learning Place	Classroom / Lab
Instructional Resources	<p>AI (Artificial Intelligence):</p> <p>Online Courses:</p> <p>Coursera - AI for Everyone by Andrew Ng</p> <p>edX - Introduction to Artificial Intelligence (AI) by Microsoft</p> <p>Books:</p> <p>"Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig</p> <p>"AI: A Very Short Introduction" by Margaret A. Boden</p> <p>YouTube Channels:</p> <p>3Blue1Brown</p> <p>Siraj Raval</p> <p>ML/DL (Machine Learning/Deep Learning):</p> <p>Online Courses:</p> <p>Coursera - Machine Learning by Andrew Ng</p> <p>Fast.ai - Practical Deep Learning for Coders</p> <p>Books:</p>

"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron

"Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville

YouTube Channels:

Siraj Raval

Two Minute Papers

Blockchain:

Online Courses:

Coursera - Blockchain Basics by ConsenSys Academy

edX - Blockchain Fundamentals by Berkeley

Books:

"Mastering Bitcoin: Unlocking Digital Cryptocurrencies" by Andreas M. Antonopoulos

"Blockchain Basics: A Non-Technical Introduction in 25 Steps" by Daniel Drescher

YouTube Channels:

Andreas M. Antonopoulos

DataDash

Data Science:

Online Courses:

Coursera - Data Science and Machine Learning Bootcamp with R

Books:

"Python for Data Analysis" by Wes McKinney

"The Art of Data Science" by Roger D. Peng and Elizabeth Matsui

YouTube Channels:

sentdex

Data School

	<p>Soft Skills:</p> <p>Online Courses:</p> <p>Coursera - Communication Skills and Teamwork</p> <p>LinkedIn Learning - Developing Your Emotional Intelligence</p> <p>Books:</p> <p>"How to Win Friends and Influence People" by Dale Carnegie</p> <p>"Emotional Intelligence 2.0" by Travis Bradberry and Jean Greaves</p> <p>YouTube Channels:</p> <p>TED Talks</p> <p>Charisma on Command</p>
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MODULES

Scheduled Weeks	Module Title	Days	Hours	Topic Title	Learning Units	Home Assignment
Week 1	Introduction and Python Basics	Day 1	Hour 1-4	Introduction to AI: AI Overview	Introduction to AI Motivational Lecture Course Introduction Job market Course Applications Work ethics Survey of career opportunities Survey of industry requirements for each seen at career path	Tasks # 1- 4
		Day 2	Hour 1-4	Linux Shell Scripting Fundamentals	Introduction to Debian Basic Commands: pwd, cd, ls, cat, sudo, man, redirection, mkdir, rm, rmdir, cp, mv file, reading, cat, more, less, head, alias, shutdown, restart, touch, nano, bash, sh, chmod, ps, kill, dpkg Package update and upgrade Environment Variables	
		Day 3	Hour 1-4	Python Fundamentals	Values, expressions, and statements Numbers, Booleans, Strings Operators, variables and keywords Fundamentals String operations Input and Type casting Comments Lists Tuples Dictionaries Sets	

		Day 4	Hour 1-4	Python Fundamentals	<p>Conditional Execution</p> <p>If, elif, and else statements</p> <p>Break, continue, and pass statements</p> <p>Nested conditionals</p> <p>Conditional (Ternary) Expression</p> <p>While, for loops and use of enumerate</p> <p>Nested loops</p> <p>List comprehension</p> <p>Iterators and Iterables</p>	
		Day 5	Hour 1-4	I/O and OOP In Python	<p>Functions</p> <p>Functions and variable scope</p> <p>Lambda expression</p> <p>Map and Filter</p> <p>Inner/Nested functions</p> <p>File Handling</p> <p>Exception Handling</p> <p>Implementation of Classes and Objects</p> <p>OOP Principals in Python</p> <p>Class Variables and Functions</p> <p>Constructors and Destructors</p> <p>Inheritance, Polymorphism and Operator Overloading</p> <p>Multilevel Inheritance</p> <p>Hierarchical Inheritance</p> <p>Multiple Inheritance, Method Resolution</p> <p>Access Specifiers: Private, Public, Protected</p> <p>Name Mangling</p> <p>Inner/Nested Class</p> <p>Association, Aggregation, Composition</p>	
Week 2	Descriptive Statistics and Probability	Day 1	Hour 1-4	Descriptive Statistics Basics	<p>Introduction to Descriptive Statistics</p> <p>Measures of Central Tendency (Mean, Median, Mode)</p> <p>Measures of Dispersion (Range, Variance, Standard Deviation)</p>	Tasks # 5- 9
		Day 2	Hour 1-4	Probability Fundamentals	<p>Introduction to Probability</p> <p>Basic Probability Rules</p> <p>Probability Distributions (Discrete and Continuous)</p>	
		Day 3	Hour 1-4	Descriptive Statistics Advanced	<p>Skewness and Kurtosis</p> <p>Percentiles and Quartiles</p> <p>Correlation and Covariance</p>	
		Day 4	Hour 1-4	Probability Distributions	<p>Common Probability Distributions (Normal, Binomial, Poisson)</p> <p>Afternoon Session:</p> <p>Probability Density Function (PDF) and Cumulative Distribution Function (CDF)</p>	
		Day 5	Hour 1-4	Overview of Python Support Libraries for EDA	<p>Introduction to Exploratory Data Analysis (EDA)</p> <p>Overview of Python Libraries (NumPy, Pandas, Matplotlib, Seaborn)</p> <p>Afternoon Session:</p> <p>Hands-on EDA using Python libraries</p>	

Week 3	Data Visualization	Day 1	Hour 1-4	Introduction to Data Visualization: Importance	Importance of Data Visualization Perception and Communication through Visuals Data Storytelling Principles of Effective Data Visualization	Tasks # 10- 14
		Day 2	Hour 1-4	Power BI Basics: Power BI Fundamentals	Introduction to Power BI Data Connections and Loading Creating Visualizations in Power BI Dashboard Design and Interactivities	
		Day 3	Hour 1-4	Matplotlib and Excel: Data Visualization with Matplotlib and Excel	Matplotlib Basics and Plotting in Python Excel for Data Visualization Customizing Visualizations Comparative Analysis using Matplotlib and Excel	
	Data Science Fundamentals	Day 4	Hour 1-4	Data Preprocessing: Techniques	Cleaning and Handling Missing Data Data Transformation and Scaling Encoding Categorical Variables Outlier Detection and Treatment	
		Day 5	Hour 1-4	Exploratory Data Analysis (EDA): EDA Techniques	Descriptive Statistics Data Visualization (Histograms, Box Plots, Scatter Plots) Correlation Analysis Univariate and Bivariate Analysis	
Week 4	Python in EDA	Day 1	Hour 1-4	Exploratory Data Analysis (EDA): EDA Techniques (cont.)	Advanced Visualization Techniques (Heatmaps, Pair Plots) Feature Engineering in EDA Insights and Patterns Extraction Practical EDA Examples	Tasks # 15- 19
		Day 2	Hour 1-4	Exploratory Data Analysis (EDA): EDA Techniques (cont.)	EDA with Time Series Data Handling Multivariate Data Dimensionality Reduction in EDA Case Studies and Projects in EDA	
		Day 3	Hour 1-4	Introduction to NumPy	Overview of NumPy and its importance in data science Basics of NumPy arrays and operations Advanced NumPy concepts (broadcasting, indexing) Practical Exercise: Hands-on coding exercises with NumPy	
		Day 4	Hour 1-4	Pandas Fundamentals	Introduction to Pandas and its data structures (Series, DataFrame) Basic operations and data manipulation with Pandas Data cleaning and preprocessing with Pandas Practical Exercise: Analyzing and cleaning datasets using Pandas	

		Day 5	Hour 1-4	Python Support Libraries for Exploratory Data Analysis (EDA)	<p>Overview of EDA and its significance in data science</p> <p>Introduction to Python support libraries (NumPy, Pandas, Matplotlib, Seaborn)</p> <p>Hands-on EDA using Python libraries</p> <p>Practical Exercise: Conducting EDA on a sample dataset</p>	
Week5	Data Mining	Day 1	Hour 1-4	Introduction to Data Mining	<p>Introduction to Data Mining</p> <p>Definition and importance</p> <p>Overview of the data mining process</p> <p>Data Exploration and Preprocessing</p> <p>Exploratory Data Analysis (EDA)</p> <p>Data cleaning and handling missing values</p> <p>Data Mining Techniques Overview</p> <p>Classification, regression, clustering, association rule mining</p> <p>An introduction to supervised and unsupervised learning</p> <p>Hands-on Session: Basic Data Mining with Tools</p> <p>Using popular tools like Weka or RapidMiner</p> <p>Simple data mining tasks with provided datasets</p>	Tasks # 20- 24
		Day 2	Hour 1-4	Classification and Regression	<p>Introduction to Classification</p> <p>Basic concepts and terminology</p> <p>Decision Trees for classification</p> <p>Regression Techniques</p> <p>Linear regression</p> <p>Polynomial regression</p> <p>Hands-on Session: Classification and Regression</p> <p>Practical exercises on classification and regression tasks</p> <p>Evaluation metrics for classification and regression models</p>	
		Day 3	Hour 1-4	Clustering and Association Rule Mining	<p>Introduction to Clustering</p> <p>K-means clustering</p> <p>Hierarchical clustering</p> <p>Association Rule Mining</p> <p>Apriori algorithm</p> <p>FP-growth algorithm</p> <p>Afternoon Session:</p>	

					Hands-on Session: Clustering and Association Rule Mining Applying clustering algorithms Extracting association rules from datasets	
		Day 4	Hour 1-4	Advanced Topics in Data Mining	Ensemble Learning Bagging and boosting Random Forests Dimensionality Reduction Principal Component Analysis (PCA) t-Distributed Stochastic Neighbor Embedding (t-SNE) Text Mining and Sentiment Analysis Techniques for mining text data Sentiment analysis applications Hands-on Session: Advanced Data Mining Techniques Practical exercises on ensemble learning, dimensionality reduction, and text mining	
		Day 5	Hour 1-4	Real-world Applications and Future Trends	Applications of Data Mining in Industry Case studies and examples Industry-specific challenges and solutions Ethical Considerations in Data Mining Privacy concerns Responsible data mining practices Future Trends in Data Mining Deep learning and its impact Emerging technologies in data mining Data Mining Project and Discussion Group projects applying data mining techniques to a real-world problem Presentation and discussion of the projects	
Week 6	Introduction to Python Data Science Libraries	Day 1	Hour 1-4	Data Visualization with Seaborn	Introduction to Seaborn and its capabilities Basic Seaborn plots (bar plots, scatter plots, histograms) Advanced Seaborn visualizations (heatmap, pair plot) Practical Exercise: Creating insightful visualizations with Seaborn	Tasks # 25- 26
		Day 2	Hour 1-4	Integration and Project Day	Morning Session: Combining NumPy, Pandas, and Seaborn for comprehensive data analysis	

					Mini-project: Applying learned concepts on a real-world dataset Q&A and troubleshooting session	
		Day 3	Hour 1-4	Introduction to AI: AI Overview, AI History and Ethics: AI Ethics	Definition and Scope of Artificial Intelligence Types of AI: Narrow AI vs. General AI Historical Context and Evolution of AI Current Landscape and Applications of AI Historical Milestones in AI Development Key Figures in AI History Ethical Considerations in AI Impact of AI on Society and the Workforce	
		Day 4	Hour 1-4	AI Applications: Real-world AI use cases	Industry-specific AI Applications (Healthcare, Finance, Manufacturing, etc.) AI in Everyday Life (Virtual Assistants, Recommendation Systems) Social and Environmental Impact of AI Applications Case Studies of Successful AI Implementations	
		Day 5	Hour 1-4	AI Applications: Real-world AI use cases	Industry-specific AI Applications (Healthcare, Finance, Manufacturing, etc.) AI in Everyday Life (Virtual Assistants, Recommendation Systems) Social and Environmental Impact of AI Applications Case Studies of Successful AI Implementations	
Week 7	AI and Data Visualization Practicals	Day 1	Hour 1-4	Foundations of AI and ML	Practical: Explore AI applications in everyday life; identify AI in virtual assistants or recommendation systems. Practical: Investigate a case study of successful AI implementation in a chosen industry.	Tasks # 27- 31
		Day 2	Hour 1-4	Unsupervised Learning and Clustering	Practical: Implement K-Means clustering on a dataset using a programming language of choice. Practical: Evaluate clustering results using appropriate metrics.	
		Day 3	Hour 1-4	Dimensionality Reduction and Neural Networks	Practical: Apply PCA or t-SNE to reduce the dimensionality of a dataset. Practical: Build a simple neural network using a framework like TensorFlow or PyTorch; experiment with different activation functions and observe their impact. Practical: Optimize the training process by adjusting hyperparameters and implementing regularization techniques.	
		Day 4	Hour 1-4	Fundamentals of Data Science	Practical: Clean and preprocess a dataset, handling missing data, and encoding categorical variables. Practical: Explore descriptive statistics and	

					create visualizations (histograms, box plots, scatter plots) for a given dataset.	
		Day 5	Hour 1-4	Exploratory Data Analysis (EDA) and Data Visualization	<p>Practical: Perform advanced data visualization techniques (heatmaps, pair plots) and feature engineering in EDA.</p> <p>Practical: Apply EDA to time series data, handle multivariate data, and conduct dimensionality reduction in EDA.</p> <p>Practical: Create a Power BI dashboard with interactive visualizations.</p> <p>Practical: Use Matplotlib in Python and Excel for data visualization, customize visualizations, and perform a comparative analysis.</p>	
Week 8	Supervised Learning	Day 1	Hour 1-4	Introduction to Supervised Learning and Basic Concepts	<p>Introduction to Machine Learning (ML)</p> <p>Overview of ML and its applications</p> <p>Distinction between supervised and unsupervised learning</p> <p>Supervised Learning Basics</p> <p>Labels, features, and training data</p> <p>Introduction to models and the training process</p> <p>Linear Regression</p> <p>Basics of regression analysis</p> <p>Implementation of linear regression</p> <p>Hands-on coding exercise with a simple dataset</p> <p>Evaluation Metrics for Regression</p> <p>Mean Squared Error (MSE), R-squared, and other metrics</p> <p>Interpreting and comparing regression models</p>	Tasks # 32- 34
		Day 2	Hour 1-4	Classification Algorithms	<p>Introduction to Classification</p> <p>Definition and examples of classification problems</p> <p>Overview of common classification algorithms</p> <p>Logistic Regression</p> <p>Basics of logistic regression</p> <p>Implementation and interpretation</p> <p>Hands-on coding exercise on binary classification</p> <p>Decision Trees and Random Forests</p> <p>Basics of decision trees</p>	

				<p>Introduction to ensemble methods with Random Forests</p> <p>Hands-on coding exercises with classification datasets</p> <p>Model Evaluation Techniques</p> <p>Confusion Matrix, Precision, Recall, F1 Score</p> <p>Cross-validation and hyperparameter tuning</p> <p>Practical tips for model evaluation and selection</p>
		Day 3	Hour 1-4	<p>Advanced Classification Techniques</p> <p>Support Vector Machines (SVM)</p> <p>Principles of SVM</p> <p>Implementation and kernel functions</p> <p>Hands-on coding exercise on SVM</p> <p>Naive Bayes Classifier</p> <p>Probability-based classification</p> <p>Implementation and use cases</p> <p>Hands-on coding exercise on text classification</p> <p>Introduction to Neural Networks</p> <p>Basics of artificial neural networks</p> <p>Feedforward and backpropagation</p> <p>Hands-on coding exercise with a simple neural network</p> <p>Practical Aspects of Training Neural Networks</p> <p>Activation functions, learning rates, and regularization</p> <p>Avoiding overfitting and underfitting</p>
		Day 4	Hour 1-4	<p>Time Series Analysis and Regression</p> <p>Introduction to Time Series Analysis</p> <p>Basics of time series data</p> <p>Time series visualization and decomposition</p> <p>Autoregressive Integrated Moving Average (ARIMA)</p> <p>Principles of ARIMA modeling</p> <p>Hands-on coding exercise on time series forecasting</p> <p>Advanced Topics in Regression</p> <p>Polynomial Regression</p> <p>Ridge and Lasso Regression for regularization</p> <p>Hands-on coding exercise with regression models</p> <p>Application of Regression in Business Cases</p> <p>Real-world business scenarios and regression</p>

					analysis Discussion on regression applications in different industries	
		Day 5	Hour 1-4	Real-world Application of Supervised Learning	Revision	
Week 9	Unsupervised Learning	Day 1	Hour 1-4	Introduction to Unsupervised Learning	Define Unsupervised Learning, compare with Supervised Learning, discuss types, and present common use cases.	Tasks # 35- 38
		Day 2	Hour 1-4	Clustering Algorithms	Explore the basics of clustering, delve into K-Means Clustering, and introduce Hierarchical Clustering.	
		Day 3	Hour 1-4	More Clustering Algorithms and Evaluation	Introduce DBSCAN and other clustering techniques, cover evaluation metrics for clustering algorithms.	
		Day 4	Hour 1-4	Dimensionality Reduction	Discuss the importance of dimensionality reduction, cover Principal Component Analysis (PCA) and t-Distributed Stochastic Neighbor Embedding (t-SNE).	
		Day 5	Hour 1-4	Advanced Topics and Practical	Explore advanced techniques in Unsupervised Learning, discuss real-world applications, and provide an overview of the Capstone Project with hands-on integration of Unsupervised Learning techniques.	
Week 10	Neural Networks	Day 1	Hour 1-4	Introduction to Neural Networks	Basics of neural networks, structure, and architecture. Activation functions and their importance.	Tasks # 39- 42
		Day 2	Hour 1-4	Deep Learning Fundamentals	Explore deep neural networks, concepts of layers, and neural network training.	
		Day 3	Hour 1-4	Neural Network Training	Techniques for training neural networks, optimization algorithms, and regularization methods.	
		Day 4	Hour 1-4	Advanced Neural Network Architectures	Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and Transfer Learning.	
		Day 5	Hour 1-4	Gradient Descent and Optimization	Understand gradient descent, optimization algorithms, regularization techniques, and best practices in training neural networks.	
Week 11	NLP + Seq Models	Day 1	Hour 1-4	Introduction to NLP: Basics of Natural Language Processing	Definition and Scope of Natural Language Processing Challenges in NLP Applications of NLP NLP in Industry	Tasks # 43- 47

		Day 2	Hour 1-4	Text Processing: Text Processing Techniques	Tokenization and Lemmatization Text Cleaning and Preprocessing Named Entity Recognition (NER) Sentiment Analysis	
		Day 3	Hour 1-4	Sequence Models: Sequence Modeling	Introduction to Sequence Models Recurrent Neural Networks (RNN) and Long Short-Term Memory (LSTM) Applications of Sequence Models Hands-on Project with Sequence Modeling	
		Day 4	Hour 1-4	Introduction to Computer Vision: Basics	Definition and Scope of Computer Vision Image Formation and Representation Applications of Computer Vision Challenges in Computer Vision	
		Day 5	Hour 1-4	Image Processing: Techniques	Image Filtering and Enhancement Image Transformation Morphological Operations Image Compression Techniques	
Week 12	Computer Vision / Object Detection & Recognition	Day 1	Hour 1-4	Feature Extraction: Methods	Feature Extraction vs. Feature Selection Popular Feature Extraction Methods Applications of Feature Extraction Feature Engineering in Computer Vision	Tasks # 48- 51
		Day 2	Hour 1-4	Object Detection Basics: Object Detection Fundamentals	Introduction to Object Detection Region-based CNN (R-CNN) Single Shot Multibox Detector (SSD) Evaluation Metrics for Object Detection	
		Day 3	Hour 1-4	Image Recognition: Image Recognition Techniques	Convolutional Neural Networks (CNN) for Image Recognition Transfer Learning in Image Recognition Image Classification Applications Case Studies in Image Recognition	
		Day 4	Hour 1-4	Object Detection Models: Object Detection Models	YOLO (You Only Look Once) Algorithm Faster R-CNN Implementing Object Detection Models with TensorFlow or PyTorch Practical Considerations in Object Detection	
		Day 5	Hour 1-4	Real-world problem for Computer Vision	Task Steps: Dataset Selection: Choose or collect a diverse dataset with annotated bounding boxes. Preprocessing: Resize, normalize, and augment the dataset for quality and diversity. Feature Extraction:	

					<p>Implement advanced feature extraction methods like HOG or deep learning-based techniques.</p> <p>Model Selection :</p> <p>Choose a suitable object detection model architecture (e.g., YOLO, Faster R-CNN, SSD). Fine-tune the model based on dataset characteristics.</p> <p>Training the Model:</p> <p>Split the dataset into training and validation sets.</p> <p>Train the model, adjusting hyperparameters for accuracy and speed.</p> <p>Evaluation:</p> <p>Assess the model's performance on the validation set using metrics like IoU and mAP.</p> <p>Testing and Inference:</p> <p>Apply the trained model to new, unseen images for real-world testing.</p> <p>Documentation and Presentation:</p> <p>Document the entire process, including dataset details, preprocessing, model architecture, training parameters, and evaluation results.</p> <p>Prepare a comprehensive presentation summarizing the project and showcasing key findings.</p>	
Week 13	ML Ops	Day 1	Hour 1-4	Introduction to ML Ops: ML Ops Overview	<p>Definition and Importance of ML Ops</p> <p>ML Ops Lifecycle</p> <p>Key Components of ML Ops</p> <p>Challenges and Best Practices in ML Ops</p>	Tasks # 52- 55
		Day 2	Hour 1-4	Azure AI 102 Basics: Microsoft Azure AI 102	<p>Overview of Microsoft Azure AI 102</p> <p>ML Ops in Microsoft Azure</p> <p>Integration of Azure Services in ML Ops</p> <p>Hands-on Labs with Azure AI 102</p>	
		Day 3	Hour 1-4	Deploying ML Models: Model Deployment on Azure	<p>Model Deployment Strategies</p> <p>Deploying Models using Azure ML</p> <p>Monitoring and Maintenance of Deployed Models</p> <p>Troubleshooting and Continuous Improvement</p>	
		Day 4	Hour 1-4	Model Monitoring and Management	<p>Understand the importance of monitoring models post-deployment and managing model versions.</p>	
		Day 5	Hour 1-4	Work on a comprehensive capstone	<p>Integration of AI, Data Science, and ML Ops Concepts</p> <p>Problem Definition and Scope of the Project</p>	

				project integrating all topics learned	Data Collection and Preprocessing for the Project Model Building, Evaluation, and Deployment in the Project	
Week 14	Basics of Blockchain and Bit Coin	Day 1	Hour 1-4	Introduction to Blockchain	Overview of decentralized systems and challenges. The need for blockchain technology.	Tasks # 56- 58
		Day 2	Hour 1-4	Structure of a Blockchain	Understanding the structure of a block in a blockchain. Anatomy of transactions.	
		Day 3	Hour 1-4	Bitcoin Overview and Mining	Introduction to Bitcoin: origin, purpose, and characteristics. Overview of the Bitcoin network.	
		Day 4	Hour 1-4	Bitcoin Transactions & Security	In-depth analysis of Bitcoin transactions. Transaction scripts, scripting language, and security.	
		Day 5	Hour 1-4	Bitcoin Security Best Practices	Importance of wallet security in Bitcoin. Best practices for securing Bitcoin assets.	
Week 15	Hands-on Bitcoin	Day 1	Hour 1-4	Introduction to Bitcoin	Revisit Bitcoin fundamentals for reinforcement.	Tasks # 59- 62
		Day 2	Hour 1-4	Setting Up a Bitcoin Wallet	Practical session on setting up different types of Bitcoin wallets.	
		Day 3	Hour 1-4	Bitcoin Transactions	Hands-on practice with Bitcoin transactions.	
		Day 4	Hour 1-4	Bitcoin Mining	Hands-on simulation of a simple mining process.	
		Day 5	Hour 1-4	Bitcoin Security	Review of security measures for Bitcoin wallets. Practical exercises implementing best practices.	
Week 16	Smart Contracts, Ethereum	Day 1	Hour 1-4	Introduction to Smart Contracts	Overview of smart contracts and their applications.	Tasks # 63-66
		Day 2	Hour 1-4	Basics of Smart Contracts	Fundamental concepts of smart contracts, scripting languages, and use cases.	
		Day 3	Hour 1-4	Ethereum Overview	Exploration of the Ethereum blockchain, features, and advantages.	
		Day 4	Hour 1-4	Ethereum Blockchain	In-depth understanding of Ethereum's blockchain structure and transaction process.	
		Day 5	Hour 1-4	Smart Contract Development	Advanced concepts in smart contract development on the Ethereum platform.	
Week 17	Decentralized Finance	Day 1	Hour 1-4	Basics of Decentralized Finance (DeFi)	Introduction to decentralized finance (DeFi) concepts, applications, and protocols.	Tasks # 67- 71
		Day 2	Hour 1-4	Decentralized Finance (DeFi)	In-depth study of decentralized finance (DeFi) and its impact on traditional finance systems.	

		Day 3	Hour 1-4	Smart Contract Development	Further exploration of advanced smart contract development techniques.	
		Day 4	Hour 1-4	DeFi Platforms	Study of various decentralized finance platforms and their specific use cases.	
		Day 5	Hour 1-4	Smart Contract Development	Final day focused on refining smart contract development skills and best practices.	
Week 18	Consensus Algorithms	Day 1	Hour 1-4	Introduction to Consensus Algorithms	Overview of consensus algorithms in blockchain networks and their role in maintaining a decentralized ledger.	Tasks # 72- 75
		Day 2	Hour 1-4	Practical Understanding of PoW and PoS	In-depth exploration of Proof-of-Work (PoW) and Proof-of-Stake (PoS) consensus mechanisms.	
		Day 3	Hour 1-4	Privacy Features in Blockchain	Understanding privacy-enhancing techniques in blockchain, including zk-SNARKs and ring signatures.	
		Day 4	Hour 1-4	Interoperability Solutions	Study interoperability challenges and solutions between different blockchain networks.	
		Day 5	Hour 1-4	Scalability Solutions	Explore scalability issues in blockchain and solutions such as sharding and layer-2 solutions.	
Week 19	Advanced Topics in Blockchain	Day 1	Hour 1-4	Emerging Trends in Blockchain	Stay updated on the latest trends, technologies, and research in the blockchain space.	Tasks # 76- 80
		Day 2	Hour 1-4	Advanced Topics in Privacy	Dive deeper into advanced privacy features and techniques, including confidential transactions and ring signatures.	
		Day 3	Hour 1-4	Case Studies on Interoperability	Explore real-world case studies where interoperability solutions have been successfully implemented.	
		Day 4	Hour 1-4	Scalability Experimentation	Hands-on experimentation with various scalability solutions, including sharding and layer-2 protocols.	
		Day 5	Hour 1-4	Future Directions in Blockchain	Discussion and exploration of potential future directions in blockchain technology and emerging trends.	
Week 20	Hyperledger	Day 1	Hour 1-4	Introduction to Hyperledger	Overview of the Hyperledger project, its goals, and the different frameworks under the Hyperledger umbrella.	Tasks # 81- 84
		Day 2	Hour 1-4	Hyperledger Fabric	In-depth exploration of Hyperledger Fabric's architecture, features, and its role in enterprise blockchain.	
		Day 3	Hour 1-4	Hyperledger Sawtooth	Understanding the architecture and components of Hyperledger Sawtooth, focusing on its unique features.	

		Day 4	Hour 1-4	Hyperledger Composer	Introduction to Hyperledger Composer for creating business networks and applications.	
		Day 5	Hour 1-4	Business Applications in Hyperledger	Explore real-world business applications using Hyperledger frameworks, including use cases and implementations.	
Week 21	Advanced Features in Hyperledger and Hands-on Practice	Day 1	Hour 1-4	Advanced Features in Hyperledger	Dive deeper into advanced features and capabilities offered by Hyperledger Fabric, Sawtooth, and Composer.	Tasks # 85-89
		Day 2	Hour 1-4	Hands-On Project: Hyperledger	Engage in a practical hands-on project that integrates concepts learned so far in a comprehensive application.	
		Day 3	Hour 1-4	Hyperledger Sawtooth Experimentation	Hands-on experimentation with Hyperledger Sawtooth, exploring transaction validation and network scalability.	
		Day 4	Hour 1-4	Hyperledger Composer Applications	Hands-on development of a business application using Hyperledger Composer.	
		Day 5	Hour 1-4	Future Trends in Hyperledger	Discussion and exploration of emerging trends and future developments within the Hyperledger ecosystem.	
Week 22	Capstone Project (AI / ML/ DL / Data Mining / Data Sc. /Blockchain/ Hyperledger)	Day 1	Hour 1-4	Project Kickoff	Capstone Project Define Capstone Project Scope: Identifying Project Goals and Objectives Defining Deliverables and Milestones Project Planning and Timeline	Tasks # 90-93
		Day 2	Hour 1-4	Research and Planning	Literature Review: Reviewing Relevant Research and Publications Identifying Gaps and Opportunities Literature Synthesis	
		Day 3	Hour 1-4	Design Phase	System Design: Architecture and Infrastructure Planning Database Design User Interface and User Experience Design	
		Day 4	Hour 1-4	Implementation	Coding and Development: Implementing Project Features Testing and Debugging Iterative Development	
		Day 5	Hour 1-4	Implementation	Coding and Development: Continue Implementing Project Features	
Week 23	Freelancing / Communication Skills	Day 1	Hour 1-4	Overview of Freelancing	Understand the gig economy, freelancing platforms, and opportunities.	Tasks # 94-97
		Day 2	Hour 1-4	Setting up a Freelancer Profile	Learn how to create a strong profile and build an effective freelancer portfolio.	
		Day 3	Hour 1-4	Effective Communication Skills	Develop communication skills crucial for interacting with clients.	

		Day 4	Hour 1-4	Negotiation Skills and Handling Feedback	Learn negotiation techniques and how to handle client feedback professionally.	
		Day 5	Hour 1-4	Introduction to Technical Writing	Explore the basics of technical writing, audience understanding, and purpose.	
Week 24	Sof Skills and Technical Writtings / Project Presentation	Day 1	Hour 1-4	Structuring Technical Documents	Learn how to structure technical documents effectively.	Tasks # 98-102
		Day 2	Hour 1-4	User Manuals and Visuals	Delve into creating user manuals and integrating visuals in technical writing.	
		Day 3	Hour 1-4	Collaborative Writing and Editing	Understand collaborative writing, version control, and effective editing.	
		Day 4	Hour 1-4	Hands-on Freelancing Project	Work on a sample project proposal and deliverable, applying freelancing skills.	
		Day 5	Hour 1-4	Final Presentations of capstone project	Project Presentation	

Tasks for Certificate in Oracle Java + Angular

Sr. No	Tasks	Schedule d Week
1	<p>Practice basic Linux commands in a virtual terminal environment. Create, move, and delete files and directories using command-line operations, Update and upgrade system packages on a Debian-based Linux distribution. Explore and modify environment variables, explaining their impact on system behavior.</p>	Week 1
2	<p>Values, Expressions, and Statements</p> <p>Write Python scripts to demonstrate the use of variables, expressions, and statements. Create examples showcasing different data types: Numbers, Booleans, Strings. Lists, Tuples, Dictionaries, and Sets</p> <p>Implement Python code to manipulate lists, tuples, dictionaries, and sets. Perform operations like indexing, slicing, and iterating through these data structures.</p>	
3	<p>Conditional Execution</p> <p>Write Python programs incorporating if, elif, and else statements for decision-making. Include break, continue, and pass statements within loops. Loops and Iteration</p> <p>Implement while and for loops to solve practical problems. Utilize nested loops and conditional expressions in solving algorithmic challenges.</p>	
4	<p>Functions and Variable Scope</p> <p>Define Python functions with various levels of variable scope. Experiment with lambda expressions, map, and filter functions. File Handling and Exception Handling</p> <p>Create Python scripts for basic file handling operations (e.g., read, write, append). Implement exception handling using try and except blocks. Object-Oriented Programming (OOP) Basics</p> <p>Develop Python classes and objects representing real-world entities. Showcase basic OOP principles, including encapsulation and inheritance. Advanced OOP Concepts</p> <p>Explore advanced OOP concepts like polymorphism and operator overloading. Design a class hierarchy demonstrating multilevel and multiple inheritance.</p>	
5	Calculating central tendency and dispersion on a dataset	Week 2

6	Understanding and applying basic probability concepts	
7	Exploring advanced descriptive statistics on real-world datasets	
8	Simulating probability distributions in Python	
9	Conducting EDA on a sample dataset with Python	
10	Learn about the significance of data visualization	Week 3
11	Create a basic Power BI dashboard	
12	Practice creating visualizations using Matplotlib and Excel	
13	Work on data cleaning and preprocessing exercises	
14	Perform EDA on a dataset using Python and libraries like Pandas and Seaborn	
15	Continue EDA exercises	Week 4
16	Complete EDA exercises	
17	<p>Basics of NumPy Arrays and Operations</p> <p>Create a Python script demonstrating the creation and manipulation of NumPy arrays. Perform basic operations (addition, subtraction, multiplication) on NumPy arrays. Advanced NumPy Concepts (Broadcasting, Indexing)</p>	
18	<p>Explain broadcasting and its role in NumPy operations. Create examples showcasing advanced indexing techniques in NumPy arrays. Practical Exercise: Hands-on Coding Exercises with NumPy</p> <p>Provide a dataset and instruct participants to perform various operations using NumPy. Encourage participants to solve specific coding challenges related to NumPy.</p>	
19	<p>Basic Operations and Data Manipulation with Pandas</p> <p>Demonstrate basic operations like selecting columns, filtering rows, and performing arithmetic operations with Pandas. Instruct participants to create a sample dataset and perform manipulations using Pandas. Data Cleaning and Preprocessing with Pandas</p> <p>Discuss common data cleaning tasks (handling missing values, removing duplicates) using Pandas. Guide participants through preprocessing steps for a messy dataset. Practical Exercise: Analyzing and Cleaning Datasets using Pandas</p>	

	<p>Provide a dataset with inconsistencies and errors.</p> <p>Instruct participants to analyze, clean, and preprocess the dataset using Pandas functions.</p>	
20	<p>Problem Definition:</p> <p>Choose a real-world problem, such as customer churn prediction or sentiment analysis.</p> <p>Data Collection and Exploration:</p> <p>Collect a relevant dataset.</p> <p>Perform exploratory data analysis (EDA) to understand data distribution.</p> <p>Data Preprocessing:</p> <p>Handle missing values, outliers, and perform necessary transformations.</p>	Week5
21	<p>Provide a classification dataset and guide participants in building a classification model.</p> <p>Evaluate the model's performance using appropriate metrics (accuracy, precision, recall).</p> <p>Offer a regression dataset and instruct participants in creating a regression model.</p> <p>Evaluate the model's performance using metrics like mean squared error or R-squared.</p> <p>Explain and demonstrate key classification metrics (accuracy, precision, recall, F1-score).</p> <p>Discuss scenarios where each metric is relevant. Explain and demonstrate common regression metrics (mean squared error, mean absolute error, R-squared).</p> <p>Interpret the significance of each metric in the context of regression models.</p>	
22	<p>Classification, Regression, and Clustering:</p> <p>Apply classification algorithms (e.g., decision trees, SVM) and regression techniques.</p> <p>Utilize clustering algorithms (e.g., K-means) to group similar data points.</p> <p>Association Rule Mining:</p> <p>Use techniques like Apriori for discovering meaningful associations in the data.</p> <p>Advanced Techniques:</p> <p>Apply advanced techniques (e.g., ensemble learning, dimensionality reduction) if applicable.</p>	
23	<p>Ensemble Learning: Bagging and Boosting</p> <p>Bagging Implementation</p> <p>Use a Python library (e.g., scikit-learn) to implement a bagging ensemble model, such as a Bagged Decision Trees model.</p> <p>Apply the model to a classification problem and compare its performance with a single decision tree.</p> <p>Boosting Implementation</p> <p>Implement a boosting ensemble model, such as AdaBoost or Gradient Boosting, using a suitable Python library.</p> <p>Apply the boosting model to a regression problem and analyze its impact on model</p>	

	<p>performance.</p> <p>Ensemble Learning: Random Forests Random Forest Implementation</p> <p>Implement a Random Forest ensemble model using a Python library. Utilize a classification dataset and evaluate the performance of the Random Forest model compared to individual decision trees. Parameter Tuning</p> <p>Experiment with hyperparameter tuning for the Random Forest model. Observe the impact of changing parameters such as the number of trees and maximum depth on model performance.</p> <p>Dimensionality Reduction: Principal Component Analysis (PCA) PCA Implementation</p> <p>Implement Principal Component Analysis (PCA) using a Python library. Apply PCA to a high-dimensional dataset and visualize the reduced-dimensional representation. Exploratory Data Analysis with PCA</p>	
24	<p>Perform EDA with PCA by analyzing the variance explained by each principal component. Identify and interpret the principal components that contribute the most to the dataset's variance.</p> <p>Dimensionality Reduction: t-Distributed Stochastic Neighbor Embedding (t-SNE) t-SNE Implementation</p> <p>Implement t-SNE using a Python library for non-linear dimensionality reduction. Apply t-SNE to a dataset and visualize the low-dimensional representation. Comparative Analysis with PCA</p> <p>Compare the results of PCA and t-SNE on the same dataset. Discuss the strengths and limitations of each method in preserving data structure.</p> <p>Text Mining and Sentiment Analysis Text Mining Techniques</p> <p>Explore text mining techniques such as tokenization, stemming, and TF-IDF. Apply these techniques to preprocess a text dataset. Sentiment Analysis Application</p> <p>Implement a sentiment analysis model using a Python library (e.g., NLTK or spaCy). Evaluate the model's accuracy and analyze the sentiments in a given dataset.</p> <p>Hands-on Session: Advanced Data Mining Techniques Advanced Data Mining Exercise</p> <p>Provide a challenging dataset and instruct participants to apply advanced data mining techniques.</p>	

	<p>Encourage the use of ensemble learning, dimensionality reduction, and text mining to derive meaningful insights.</p> <p>Results Presentation</p> <p>Have participants present their findings and discuss the impact of employing advanced data mining techniques.</p> <p>Encourage discussions on challenges faced and potential improvements.</p>	
25	Read introductory material on AI, Discuss ethical considerations in AI	Week 6
26	Explore real-world AI use cases	
27	<p>Practical: Explore AI applications in everyday life; identify AI in virtual assistants or recommendation systems.</p> <p>Practical: Investigate a case study of successful AI implementation in a chosen industry.</p>	Week 7
28	<p>Practical: Implement K-Means clustering on a dataset using a programming language of choice.</p> <p>Practical: Evaluate clustering results using appropriate metrics.</p>	
29	<p>Practical: Apply PCA or t-SNE to reduce the dimensionality of a dataset.</p> <p>Practical: Build a simple neural network using a framework like TensorFlow or PyTorch; experiment with different activation functions and observe their impact.</p> <p>Practical: Optimize the training process by adjusting hyperparameters and implementing regularization techniques.</p>	
30	<p>Practical: Clean and preprocess a dataset, handling missing data, and encoding categorical variables.</p> <p>Practical: Explore descriptive statistics and create visualizations (histograms, box plots, scatter plots) for a given dataset.</p>	
31	<p>Practical: Perform advanced data visualization techniques (heatmaps, pair plots) and feature engineering in EDA.</p> <p>Practical: Apply EDA to time series data, handle multivariate data, and conduct dimensionality reduction in EDA.</p> <p>Practical: Create a Power BI dashboard with interactive visualizations.</p> <p>Practical: Use Matplotlib in Python and Excel for data visualization, customize visualizations, and perform a comparative analysis.</p>	
32	<p>Present a case study where the choice between supervised and unsupervised learning is crucial.</p> <p>Discuss potential challenges and benefits associated with the chosen approach. Introduce a sample dataset, highlighting the features and labels. Demonstrate the implementation of linear regression using a Python library (e.g., scikit-learn). fit a linear regression model to a dataset. Provide a theoretical explanation of mean squared error (MSE), R-squared, and other regression metrics.</p> <p>Discuss scenarios where each metric is appropriate.</p>	Week 8

33	<p>Coding Assignment 1: Support Vector Machines (SVM) Task: Implement SVM for Classification</p> <p>Use a Python machine learning library (e.g., scikit-learn) to implement an SVM model for a given classification dataset. Explore different kernel functions (linear, polynomial, radial basis function) and compare their impact on classification performance. Evaluate the model using appropriate metrics (accuracy, precision, recall) and visualize the decision boundaries.</p> <p>Coding Assignment 2: Naive Bayes Classifier Task: Text Classification with Naive Bayes</p> <p>Implement a Naive Bayes classifier for text classification using a Python library (e.g., NLTK or scikit-learn). Utilize a text dataset (e.g., sentiment analysis) and preprocess the data for classification. Train the Naive Bayes model and evaluate its performance using accuracy and confusion matrix. Experiment with different text preprocessing techniques (e.g., stemming, lemmatization) and analyze their impact on classification results.</p> <p>Coding Assignment 3: Introduction to Neural Networks Task: Build a Simple Neural Network</p> <p>Use a deep learning framework (e.g., TensorFlow or PyTorch) to build a simple neural network. Create a dataset suitable for binary classification. Implement a feedforward neural network with one hidden layer. Train the model using backpropagation and optimize hyperparameters (learning rate, activation function). Evaluate the neural network's performance on the test set and visualize the decision boundaries.</p> <p>Coding Assignment 4: Practical Aspects of Training Neural Networks Task: Overfitting and Regularization</p> <p>Implement a neural network with a moderate number of hidden layers. Train the model on a dataset, allowing it to overfit. Apply regularization techniques such as dropout or L2 regularization to mitigate overfitting. Compare the performance of the regularized model with the overfit model using appropriate metrics. Discuss the impact of regularization on the model's ability to generalize.</p>	
34	<p>Practical Tasks for Introduction to Time Series Analysis:</p> <p>1. Basics of Time Series Data Task: Exploring Time Series Dataset</p> <p>Provide a sample time series dataset (e.g., stock prices, weather data).</p>	

Instruct participants to load and explore the dataset using Python (e.g., pandas library).
Have them analyze basic statistics, identify trends, and discuss seasonality.

2. Time Series Visualization and Decomposition
Task: Visualizing Time Series Components

Introduce a time series dataset with clear trends and seasonality.
Guide participants in visualizing the time series, decomposing it into trend, seasonality, and residual components using Python (e.g., matplotlib, statsmodels).

3. Autoregressive Integrated Moving Average (ARIMA)
Task: ARIMA Modeling for Forecasting

Present a time series dataset suitable for forecasting (e.g., monthly sales).
Instruct participants to build an ARIMA model using Python (e.g., statsmodels).
Evaluate the model's performance, make predictions, and visualize the forecast.

Practical Tasks for Advanced Topics in Regression:

1. Polynomial Regression
Task: Polynomial Regression Implementation

Provide a dataset with non-linear relationships.
Instruct participants to implement polynomial regression using Python (e.g., scikit-learn).
Experiment with different polynomial degrees and visualize the regression curve.

2. Ridge and Lasso Regression for Regularization
Task: Regularized Regression

Present a dataset prone to multicollinearity.
Guide participants in implementing Ridge and Lasso regression using Python (e.g., scikit-learn).
Discuss the impact of regularization on model coefficients.

3. Hands-on Coding Exercise with Regression Models
Task: Comprehensive Regression Exercise

Combine the concepts of simple linear regression, polynomial regression, and regularization.
Provide a diverse dataset and instruct participants to apply appropriate regression techniques using Python.
Emphasize feature engineering, model evaluation, and result interpretation.

Practical Task for Application of Regression in Business Cases:
Task: Regression in Business Decision-Making

Present real-world business scenarios from various industries (e.g., retail, finance, healthcare).
In groups, participants discuss and propose regression models to address specific business challenges.
Each group presents their approach, discusses potential impacts, and justifies their choice of regression models.

35	Implement K-Means on a given dataset.	Week 9
36	Evaluate and compare clustering algorithms on a sample dataset.	
37	Apply PCA and t-SNE to reduce dimensionality in a real-world dataset.	
38	Integrate Unsupervised Learning techniques into the Capstone Project.	
39	Implement a simple feedforward neural network using a chosen framework.	Week 10
40	Optimize and train the neural network with various techniques.	
41	Implement a CNN or RNN for a specific task.	
42	Fine-tune and optimize the neural network using advanced techniques.	
43	Read about NLP applications	Week 11
44	Implement basic text processing tasks	
45	Work on a sequence modeling project	
46	Watch video lectures on computer vision	
47	Implement basic image processing operations	
48	Understand feature extraction methods	Week 12
49	Explore object detection algorithms	
50	Implement image recognition tasks	
51	Implement object detection using pre-trained models	
52	Understand the importance of ML Ops	Week 13
53	Explore ML Ops in the context of Microsoft Azure	
54	Deploy a machine learning model using Azure services	
55	Implement model monitoring and version management using Azure tools.	
56	Simulate a simple mining process.	Week 14
57	Implement security measures for a Bitcoin wallet. Analyze Bitcoin transactions.	
58	Implement additional security measures and reinforce best practices.	
59	Set up and configure a Bitcoin wallet.	Week 15
60	Execute and verify Bitcoin transactions.	

61	Simulate and understand the steps involved in Bitcoin mining.	
62	Implement additional security measures and reinforce best practices.	
63	Write a simple smart contract.	Week 16
64	Set up a local Ethereum node and interact with the Ethereum network.	
65	Analyze Ethereum transactions and blocks.	
66	Develop and deploy a more complex smart contract on the Ethereum network.	
67	Explore and interact with popular DeFi platforms.	Week 17
68	Evaluate and experiment with different DeFi protocols.	
69	Develop a smart contract with additional functionalities.	
70	Explore the functionalities and applications of different DeFi platforms.	
71	Review and improve the previously developed smart contracts.	
72	Analyze strengths and weaknesses of PoW and PoS through practical examples.	Week 18
73	Implement a basic privacy feature in a sample blockchain.	
74	Experiment with cross-chain transactions using interoperability tools.	
75	Evaluate and implement scalability solutions for a sample blockchain.	
76	Research and present a brief on emerging trends in blockchain.	Week 19
77	Implement an advanced privacy feature in a sample blockchain.	
78	Analyze the impact of interoperability in actual blockchain projects.	
79	Evaluate the performance of different scalability techniques in a simulated environment.	
80	Present findings and insights on the future of blockchain based on current trends.	
81	Set up a simple Hyperledger Fabric network and deploy a basic smart contract.	Week 20
82	Simulate a transaction flow in a Hyperledger Sawtooth network.	
83	Create a simple business network using Hyperledger Composer.	
84	Research and present a case study on a business application in Hyperledger.	
85	Implement and experiment with advanced features in a Hyperledger network.	Week 21

86	Work on a comprehensive project applying Hyperledger frameworks to solve a real-world problem.	
87	Evaluate the performance of Hyperledger Sawtooth and implement scalability solutions.	
88	Develop a sample business application and integrate it with Hyperledger Composer.	
89	Research and present insights on potential future directions in Hyperledger technology.	
90	Define the scope, goals, and deliverables of the capstone project	Week 22
91	Conduct research and plan the implementation of the capstone project	
92	Develop the system design and architecture for the capstone project	
93	Begin coding and implementing the capstone project	
94	Complete profile setup and portfolio building.	Week 23
95	Participate in communication exercises.	
96	Role-play negotiation scenarios and feedback response.	
97	Analyze a sample technical document.	
98	Create an outline for a technical document.	Week 24
99	Develop a sample user manual with visuals.	
100	Collaboratively edit a technical document.	
101	Create and present a sample project proposal.	
102	Present technical writing and capstone project.	

Motivational Lectures
AI/ML/DL+DATA SCIENCE + BLOCKCHAIN+SOFT SKILLS

AI (Artificial Intelligence):

Online Courses:

Coursera - AI for Everyone by Andrew Ng

edX - Introduction to Artificial Intelligence (AI) by Microsoft

Books:

"Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig

"AI: A Very Short Introduction" by Margaret A. Boden

YouTube Channels:

3Blue1Brown

Siraj Raval

ML/DL (Machine Learning/Deep Learning):

Online Courses:

Coursera - Machine Learning by Andrew Ng

Fast.ai - Practical Deep Learning for Coders

Books:

"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron

"Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville

YouTube Channels:

Siraj Raval

Two Minute Papers

Blockchain:

Online Courses:

Coursera - Blockchain Basics by ConsenSys Academy

edX - Blockchain Fundamentals by Berkeley

Books:

"Mastering Bitcoin: Unlocking Digital Cryptocurrencies" by Andreas M. Antonopoulos

"Blockchain Basics: A Non-Technical Introduction in 25 Steps" by Daniel Drescher

YouTube Channels:

Andreas M. Antonopoulos

DataDash

Data Science:

Online Courses:

Coursera - Data Science and Machine Learning Bootcamp with R

Books:

"Python for Data Analysis" by Wes McKinney

"The Art of Data Science" by Roger D. Peng and Elizabeth Matsui

YouTube Channels:

sentdex

Data School

Soft Skills:

Online Courses:

Coursera - Communication Skills and Teamwork

LinkedIn Learning - Developing Your Emotional Intelligence

Books:

"How to Win Friends and Influence People" by Dale Carnegie

"Emotional Intelligence 2.0" by Travis Bradberry and Jean Greaves

YouTube Channels:

TED Talks

Charisma on Command

Workplace/Institute Ethics Guide

Work ethic is a standard of conduct and values for job performance. The modern definition of what constitutes good work ethics often varies. Different businesses have different expectations. Work ethic is a belief that hard work and diligence have a moral benefit and an inherent ability, virtue, or value to strengthen character and individual abilities. It is a set of values-centered on the importance of work and manifested by determination or desire to work hard.

The following ten work ethics are defined as essential for student success:

1. Attendance:

Be at work every day possible, plan your absences don't abuse leave time. Be punctual every day.

2. Character:

Honesty is the single most important factor having a direct bearing on the final success of an individual, corporation, or product. Complete assigned tasks correctly and promptly. Look to improve your skills.

3. Team Work:

The ability to get along with others including those you don't necessarily like. The ability to carry your weight and help others who are struggling. Recognize when to speak up with an idea and when to compromise by blend ideas together.

4. Appearance:

Dress for success set your best foot forward, personal hygiene, good manner, remember that the first impression of who you are can last a lifetime

5. Attitude:

Listen to suggestions and be positive, accept responsibility. If you make a mistake, admit it. Values workplace safety rules and precautions for personal and co-worker safety. Avoids unnecessary risks. Willing to learn new processes, systems, and procedures in light of changing responsibilities.

6. Productivity:

Do the work correctly, quality and timelines are prized. Get along with fellows, cooperation is the key to productivity. Help out whenever asked, do extra without being asked. Take pride in your work, do things the best you know-how. Eagerly focuses energy on accomplishing tasks, also referred to as demonstrating ownership. Takes pride in work.

7. Organizational Skills:

Make an effort to improve, learn ways to better yourself. Time management; utilize time and resources to get the most out of both. Take an appropriate approach to social interactions at work. Maintains focus on work responsibilities.

8. Communication:

Written communication, being able to correctly write reports and memos. Verbal communications, being able to communicate one on one or to a group.

9. Cooperation:

Follow institute rules and regulations, learn and follow expectations. Get along with fellows, cooperation is the key to productivity. Able to welcome and adapt to changing work situations and the application of new or different skills.

10. Respect:

Work hard, work to the best of your ability. Carry out orders, do what's asked the first time. Show respect, accept, and acknowledge an individual's talents and knowledge. Respects diversity in the workplace, including showing due respect for different perspectives, opinions, and suggestions.