INTERNATIONAL QUALIFICATIONS

AND ASSESSMENT CENTRE (IQAC)

«Approved»

2025 y. «16» Iyul

Programme	**LEVEL 4 EXTENDED DIPLOMA IN DATA SCIENCE**		
Unit Number/ Unit Title	UNIT 6 MACHINE LEARNING FOUNDATIONS		
Cohort Code:	L04MLF-U6		
Unit Level	Level 4		
Total GLH	Total qualification time 200/ Total Guided learning hours 90/ Self-guided learning hours 110		
Credits	20 CATS/ 10 ECTS		
Lecturer			
Start Date		**End Date**	

Unit Aims	This module aims to introduce students to the principles and techniques of machine learning and their application in data science. Students will acquire the statistical foundations essential for analyzing and interpreting data within the field of data science. The module will cover key concepts such as descriptive statistics, inferential statistics, probability theory, and hypothesis testing. Students will learn how to apply statistical methods to real-world data, interpret results, and make data-driven decisions. By the end of the module, students will be proficient in using statistical techniques to extract insights from data, laying a solid groundwork for advanced data analysis and modeling.
Differentiation Strategies *(e.g. planned activities or support for individual learners according to their needs)*	The total number of students to be in the lesson is approximately 20. This is a multicultural group of students predominantly between the ages of 24 – 45, with numerous ethnic, gender, and creed background. These are UK academic level 5 students; hence it is assumed that they have practical, theoretical, or technological knowledge and understanding of a subject or field of work to find ways forward in broadly defined, complex contexts. These students must be able to generate information, evaluate, synthesise the use information from a variety of sources. Various approaches to addressing the various identified students needs will be adopted throughout the lesson. Such will include:-

	1. Progressive tasks 2. Digital resources 3. Verbal support 4. Variable outcomes 5. Collaborative learning 6. Ongoing assessment 7. Flexible-pace learning
Equality & Diversity	Variety of teaching techniques will be employed to ensure that the needs of each individual learner are met.
Safeguarding & Prevent	Safeguarding policies and the Prevent duty are strictly observed to ensure the safety, well-being, and inclusivity of all students and staff.
Health & Safety	SIRM H&S policies will be maintained.
Learning Resources	**Teaching and Learning Materials** • Hastie, T., Tibshirani, R., & Friedman, J. (2009). The Elements of Statistical Learning: Data Mining, Inference, and Prediction. Springer Science & Business Media. • Murphy, K. P. (2012). Machine Learning: A Probabilistic Perspective. MIT Press. • Raschka, S., & Mirjalili, V. (2019). Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow. Packt Publishing.

Learning Outcome	Assessment Criteria
1. Understand the fundamentals of machine learning.	1.1 Define machine learning and its relationship to artificial intelligence. 1.2 Explain supervised and unsupervised learning techniques.
2. Develop skills in applying machine learning algorithms.	2.1 Implement classification and regression algorithms. 2.2 Use clustering and dimensionality reduction techniques.
3. Apply machine learning models to real-world data.	3.1 Evaluate model performance using appropriate metrics. 3.2 Interpret machine learning results and make data driven decisions

No	Learning Outcome / Topic	Learning and Teaching Activities	Which assessment criteria does the session relate to?	Day/month/year/ signature
1.	**Introduction to Machine Learning (ML)**	**Introduction to Machine Learning (ML)** Definition, history, and relationship with AI	LO1: Fundamentals of Machine Learning	
2.	**Types of ML: Supervised vs. Unsupervised**	**Types of ML: Supervised vs. Unsupervised** Key differences, use cases, and examples	LO1: Fundamentals of Machine Learning	
3.	**Real-World Applications of ML**	**Real-World Applications of ML** Healthcare, finance, marketing, and automation	LO1: Fundamentals of Machine Learning	
4.	**Ethical Considerations in ML**	**Ethical Considerations in ML** Bias, fairness, and responsible AI practices	LO1: Fundamentals of Machine Learning	
5.	**Python for ML**	**Python for ML** Introduction to libraries (Scikit-learn, Pandas, NumPy)	LO1: Fundamentals of Machine Learning	
6.	**Linear Regression**	**Linear Regression** Theory, assumptions, and implementation	LO2: Supervised Learning	
7.	**Logistic Regression**	**Logistic Regression** Binary classification, sigmoid function	LO2: Supervised Learning	
8.	Half-Term Exam	- Review of LO1 topics - Practice questions and mock assessment - **Half-term assessment** based on LO1 (theory)	LO1 LO2	
9.	**Decision Trees & Random Forests**	**Decision Trees & Random Forests** Splitting criteria, ensemble methods	LO2: Supervised Learning	
10.	**Support Vector Machines (SVM)**	**Support Vector Machines (SVM)** Hyperplanes, kernels (linear, RBF)	LO2: Supervised Learning	

11.	**Model Evaluation (Supervised)**	**Model Evaluation (Supervised)** Accuracy, precision, recall, ROC-AUC	LO2: Supervised Learning	
12.	**Clustering Basics**	**Clustering Basics** K-Means, hierarchical clustering	LO3: Unsupervised Learning	
13.	**Dimensionality Reduction**	**Dimensionality Reduction** PCA (Principal Component Analysis), t-SNE	LO3: Unsupervised Learning	
14.	Final Exam Preparation & Review	- Comprehensive review of all learning outcomes - Practice questions and revision of key topics		
15.	Final Exam	- **Final-term assessment** covering all learning outcomes (theory and practical elements)		
16.	Feedback & Reflection	- Review of final exam - Individual feedback on performance - Reflective discussion on key learning points		
17.	**Anomaly Detection**	**Anomaly Detection** Isolation Forest, DBSCAN	LO3: Unsupervised Learning	
18.	**Association Rule Learning**	**Association Rule Learning** Apriori algorithm, market basket analysis	LO3: Unsupervised Learning	
19.	**Model Evaluation (Unsupervised)**	**Model Evaluation (Unsupervised)** Silhouette score, elbow method	LO3: Unsupervised Learning	
20.	**Train-Test Split & Cross-Validation**	**Train-Test Split & Cross-Validation** K-fold, stratified sampling	LO4: Model Deployment & Interpretation	
21.	**Hyperparameter Tuning**	**Hyperparameter Tuning** Grid search, random search	LO4: Model Deployment & Interpretation	

22.	**Feature Engineering**	**Feature Engineering** Handling missing data, categorical encoding	LO4: Model Deployment & Interpretation	
23.	Half-Term Exam	**End-to-End ML Pipeline** Data cleaning → modeling → evaluation		
24.	**Bias-Variance Tradeoff** Overfitting vs. underfitting, regularization	**Bias-Variance Tradeoff** Overfitting vs. underfitting, regularization	LO4: Model Deployment & Interpretation	
25.	**Explainable AI (XAI)** SHAP, LIME for model interpretability	**Explainable AI (XAI)** SHAP, LIME for model interpretability	LO4: Model Deployment & Interpretation	
26.	**Case Study: Predictive Modeling** and **Deploying ML Models**	**Case Study: Predictive Modeling** Build a classifier/regressor on a real dataset **Deploying ML Models** Flask API, cloud deployment (AWS/GCP)		
27.	**Future Trends in ML**	**Future Trends in ML** AutoML, federated learning, quantum ML	LO5: Capstone Project & Advanced Topics	
28.	**Final Project Presentation**	**Final Project Presentation** Solve a business problem using ML	LO5: Capstone Project & Advanced Topics	
29.	Final Exam Preparation & Review	LO1, LO2, LO3, LO4	LO1, LO2, LO3, LO4	
30.	Final Exam		LO1, LO2, LO3, LO4	