INTERNATIONAL QUALIFICATIONS

AND ASSESSMENT CENTRE (IQAC)

«Approved»

2025 y. «16» 04

Programme	**LEVEL 5 EXTENDED DIPLOMA IN ARTIFICIAL INTELLIGENCE**		
Unit Number/ Unit Title	UNIT 8 DEEP LEARNING AND NEURAL NETWORKS		
Cohort Code:	L05DLN-U8		
Unit Level	5		
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	Students will explore various neural network types, including convolutional and recurrent networks, and learn techniques for improving model performance such as regularization and optimization. The unit will also cover practical implementation using popular deep learning frameworks, with a focus on real-world applications and ethical considerations in AI development.
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** • "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville • "Neural Networks and Deep Learning" by Michael Nielsen • "Hands-On Deep Learning with TensorFlow" by Dan Van Boxel • "Deep Learning with Python" by François Chollet • "Deep Reinforcement Learning Hands-On" by Maxim Lapan.

Learning Outcome	Assessment Criteria
LO1. Understand the architecture of neural networks.	1.1 Describe the structure and functioning of artificial neural networks. 1.2 Explain different types of neural networks, including feedforward, convolutional, and recurrent neural networks. 1.3 Discuss the role of activation functions and their impact on neural network performance.
LO2. Implement deep learning models.	2.1 Develop deep learning models using frameworks like TensorFlow and PyTorch. 2.2 Train and fine-tune neural networks for various tasks. 2.3 Implement and evaluate different optimization algorithms such as SGD, Adam, and RMSprop.
LO3. Utilize advanced neural network techniques	3.1. Implement techniques such as transfer learning and fine-tuning. 3.2: Apply techniques for regularization such as dropout and batch normalization. 3.3: Use advanced architectures like GANs (Generative Adversarial Networks) and autoencoders.
LO4. Apply deep learning to specialized tasks.	4.1 Use deep learning for image classification and object detection. 4.2 Implement natural language processing tasks using neural networks. 4.3 Develop applications for time-series forecasting and anomaly detection.

No	Learning Outcome / Topic	Learning and Teaching Activities	Which assessment criteria does the session relate to?	Day/month/year/ signature
1.	**Introduction to Neural Networks**	**Introduction to Neural Networks** Biological vs. artificial neurons, perceptron model	LO1: Neural Network Architecture (Theory)	
2.	**Feedforward Neural Networks**	**Feedforward Neural Networks** Architecture, forward propagation, layer types	LO1: Neural Network Architecture (Theory)	
3.	**Activation Functions Deep Dive**	**Activation Functions Deep Dive** Sigmoid, ReLU, LeakyReLU, Swish - pros/cons	LO1: Neural Network Architecture (Theory)	
4.	**Loss Functions & Backpropagation**	**Loss Functions & Backpropagation** MSE, cross-entropy, chain rule application	LO1: Neural Network Architecture (Theory)	
5.	**Types of Neural Networks Overview**	**Types of Neural Networks Overview** CNN, RNN, LSTM, Transformer architectures	LO1: Neural Network Architecture (Theory)	
6.	**TensorFlow/PyTorch Comparison**	**TensorFlow/PyTorch Comparison** Graph vs. eager execution, syntax differences	LO2: Deep Learning Implementation (Practical)	
7.	**Building Your First Neural Network**	**Building Your First Neural Network** MNIST classification from scratch	LO2: Deep Learning Implementation (Practical)	
8.	Half-Term Exam	- Review of LO1 topics - Practice questions and mock assessment - **Half-term assessment** based on LO1 (theory)	LO1 LO2	
9.	**Training Dynamics**	**Training Dynamics** Epochs, batches, learning rates, loss curves	LO2: Deep Learning Implementation (Practical)	
10.	**Optimization Algorithms**	**Optimization Algorithms** SGD, Momentum, Adam, RMSprop implementations	LO2: Deep Learning Implementation (Practical)	
11.	**Hyperparameter Tuning Lab**	**Hyperparameter Tuning Lab** Learning rate schedules, batch size impact	LO2: Deep Learning Implementation (Practical)	

12.	**Regularization Methods**	**Regularization Methods** Dropout, L1/L2, early stopping implementations	LO3: Advanced Techniques	
13.	**Batch Normalization**	**Batch Normalization** Theory and practical implementation	LO3: Advanced Techniques	
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.	**Transfer Learning Workshop**	**Transfer Learning Workshop** Fine-tuning pretrained models (VGG16, ResNet)	LO3: Advanced Techniques	
18.	**Autoencoders**	**Autoencoders** Architecture, latent space visualization	LO3: Advanced Techniques	
19.	**Generative Adversarial Networks (GANs)**	**Generative Adversarial Networks (GANs)** DCGAN implementation for image generation	LO3: Advanced Techniques	
20.	**Image Classification**	**Image Classification** Advanced CNN architectures (EfficientNet)	LO4: Specialized Applications	
21.	**Object Detection**	**Object Detection** YOLO, Faster R-CNN implementations	LO4: Specialized Applications	
22.	**Natural Language Processing Basics**	**Natural Language Processing Basics** Word embeddings, sentiment analysis	LO4: Specialized Applications	
23.	Half-Term Exam	**Project** End-to-end DL solution (student's choice of application)	LO4: Specialized Applications	

24.	**Sequence Modeling**	**Sequence Modeling** LSTM for time-series forecasting	LO4: Specialized Applications	
25.	**Attention Mechanisms**	**Attention Mechanisms** Transformer architecture introduction	LO4: Specialized Applications	
26.	**Anomaly Detection**	**Anomaly Detection** Autoencoder-based approaches	LO4: Specialized Applications	
27.	**Model Interpretability**	*Capstone & Emerging Topics* **Model Interpretability** Grad-CAM, attention visualization	LO4: Specialized Applications	
28.	**Edge Deployment**	*Capstone & Emerging Topics* **Edge Deployment** Quantization, TensorFlow Lite **Ethics in Deep Learning** Bias mitigation, model cards	LO4: Specialized Applications	
29.	Final Exam Preparation & Review	LO1, LO2, LO3, LO4	LO1, LO2, LO3, LO4	
30.	Final Exam		LO1, LO2, LO3, LO4	