Final Semester Plan: "Intro to Math of Neural Networks"

Foundation in Regression and Classification (Up to March 03)

0. **01/15** – Introduction & Course Overview
1. **01/20** – Datasets: Understanding Data & Preprocessing
2. **01/22** – Framework of Supervised ML (Features, Labels, Training, and Testing)
3. **01/27** – Introduction to Regression: Concepts & Use Cases
4. **01/29** – Simple Linear Regression (Mathematical Formulation, Least Squares)
5. **02/03** – Multiple Linear Regression (Feature Interactions, Overfitting)
6. **02/05** – Multiple Linear Regression (Regularization, Multicollinearity)
7. **02/10** – Polynomial Regression (Non-linearity and Model Complexity)
8. **02/12** – **Basic Statistics for ML** (Mean, Variance, Covariance, Normalization)
9. **02/17** – **Probability for ML** (Distributions, Bayes' Theorem, Maximum Likelihood Estimation)
10. **02/19** – Introduction to Binary Classification (Decision Boundaries, Thresholding)
11. **02/24** – Logistic Regression (Mathematical Formulation, Sigmoid Function)
12. **02/26** – Confusion Matrix, Precision, Recall, and ROC Curves
13. **03/03** – Multinomial Logistic Regression & Softmax

Core Neural Network Concepts (March 5 – April 7)

14. **03/05** – Introduction to Perceptrons & XOR Problem
15. **03/17** – Multilayer Perceptrons (MLPs) & Forward Propagation
16. **03/19** – Loss Functions & Optimization (Gradient Descent, Backpropagation Intro)
17. **03/24** – Implementing an MLP for MNIST (Hands-on)

18. **03/26** – Regularization in Neural Networks (Dropout, Batch Normalization)
19. **03/31** – Advanced Optimization: Adam, RMSProp, Learning Rate Scheduling

    Project 1 due
20. **04/02** – Introduction to Convolutional Neural Networks (CNNs)
21. **04/07** – Convolutions, Feature Maps, and Pooling Layers
22. **04/09** – Implementing CNNs for Image Classification (Hands-on)

Fine-Tuning and Project Preparation (April 14 – April 23)

23. **04/14** – Architectures of CNNs: LeNet, AlexNet, ResNet
24. **04/16** – Introduction to Fine-Tuning & Transfer Learning (Concepts, Why It Works)
25. **04/21** – Fine-Tuning Pretrained Models (ResNet, VGG, EfficientNet)
26. **04/23** – Hands-on Fine-Tuning Session & Troubleshooting

Broader Topics in Deep Learning (Final Weeks)

27. **04/28** – Introduction to Recurrent Neural Networks (RNNs)
28. **04/30** – Introduction to Transformers & Self-Attention