Indian Institute of Technology, Kanpur

Proposal for ~~a New~~ Course Revision

1. Course No: ME644

2. Course Title: Machine Learning for Engineers

3. Per Week Lectures: 3 (L), Tutorial: 0 (T), Laboratory: 0 (P), Additional Hours: 0 (A), Credits (3*L+2*T+P+A): 9 Duration of Course: Full Semester / ~~Modular~~

4. Proposing Department/IDP: Mechanical Engineering

   Other Departments/IDPs which may be interested in the proposed course: AE

   Other faculty members interested in teaching the proposed course:

5. Proposing Instructor(s): Malay K. Das, Dipayan Mukherjee, Siddhartha Mukherjee

6. Course Description:

A) Objectives:

The course covers fundamental machine learning techniques and their applications in engineering problem-solving. Successful completion of this course will help students to solve various problems of mechanical engineering using data-driven techniques.

B) Contents (*preferably in the form of 5 to 10 broad titles)*: 39 lectures

S. No	Broad Title	Topics	No. of Lectures
1	Overview of Various ML Models	Supervised Learning: Linear and nonlinear regressions, regularization, k-nearest neighbor, logistic regression, ensemble learning	6
2		Probabilistic Models: Introductory probability, MLE, MAP, Naïve-Bayes	4
3		Unsupervised Learning: Clustering, Dimensionality Reduction	2
4	Neural Networks and Deep Learning	Single- and multi-layered Perceptrons	6
5		Convolutional, Recurrent, and Graph Neural Networks	6
6		Autoencoders, Generative Adversarial Networks, Mixture Models	4
7	Machine Learning in Engineering: Hands-on Exercises	Physics-informed neural network: applications in direct and inverse problems in mechanics	6
8		Surrogate models, and reduced-order models in mechanics	5

C) Pre-requisites, if any (*examples: a- PSO201A,or b- PSO201A or equivalent*): NIL

D) Short summary for including in the Courses of Study Booklet

Regression, Classification, Clustering, Dimensionality reduction; Neural networks, CNN, RNN, GNN; Direct and inverse problems in mechanics, surrogate models, reduced-order models

7. Recommended books:
   Textbooks Goodfellow et al., *Deep Learning*, MIT Press

   Reference Books:
   1. C. M. Bishop, *Deep Learning*, Springer
   2. Yagawa and Oishi, *Computational Mechanics with Deep Learning*, Springer
   3. Kollmansberger, *Deep Learning in Computational Mechanics*, Springer
   4. K. Garikipati, *Data-driven Modeling and Scientific ML in Continuum Physics*, Springer
   5. S. L. Brunton and J. L. Kutz, *Data-driven Science and Engineering*, CUP
   6. C. M. Bishop, *Pattern Recognition and Machine Learning*, Springer
   7. R. G. McClarren, *Machine Learning for Engineers*, Springer
   8. G. James et al., *Introduction to Statistical Learning*, Springer
   9. J. Watt et al., *Machine Learning Refined*, 2nd ed., CUP

8. Any other remarks: nil

Dated: 03.11.2026 Proposer: Malay Das

Dated:_____ DUGC/DPGC Convener:_____

The course is approved / not approved

Chairman, SUGC/SPGC

Dated:_____