

ISEN 4810 - Special Topics

Fall 2026 Syllabus, Section 01, CRN 43565,

Credit hours: 3

Instructor

Zefeng Lyu

Email: zlyu@ysu.edu

Instructor Title: Assistant Professor

Instructor Professional Qualifications: Ph.D., Industrial Engineering, University of Tennessee, 2023

Instructor Office Location: Moser Hall 2442

Instructor Office Phone: (330) 941-7455

Course Description

4810. Special Topics. Special topics and new developments in Industrial Engineering. Subject matter, credit hours, and special prerequisites to be announced in advance of each offering. Prereq.: senior standing in Industrial Engineering or consent of instructor. 3 s.h.

The topic of this offering is Artificial Intelligence for Engineering Applications: Introduction to artificial intelligence methods and their applications across engineering. The course is organized into four modules: machine learning, deep learning, reinforcement learning, and large language models. Engineering data analytics (data wrangling, visualization, and statistical analysis) is integrated throughout as the working foundation of each module. Applications are drawn from across the engineering disciplines, including production scheduling, quality inspection, predictive maintenance, structural health monitoring, load forecasting, fault detection, and process monitoring and optimization. This is a strongly hands-on course: every module pairs projects/mini-projects, and students use Python, Github, and modern AI tools to build, validate, and communicate working solutions. Through module projects and a final project, students are expected to formulate and solve problems drawn from their own engineering background and interests.

Course Readings

Group	Title	Author	ISBN
No textbook purchase is required			

Lecture notes, Jupyter notebooks, datasets, and tutorials will be provided by the instructor. Each module of the course is supported by a free online textbook and a companion code repository

The course readings are subject to change in the event of extenuating circumstances, research developments, current events, and/or to ensure better learning.

Schedule of Topics and Assignments

Day	Date	Proposed Topic	Due/To Prepare for Class
Tue	8/25	Course introduction, toolchain and AI assistants	
Thu	8/27	Data wrangling and EDA	HW1 assigned
Tue	9/1	Linear regression and feature engineering	
Thu	9/3	Model validation I	HW1 due · HW2 assigned
Tue	9/8	Regularization	
Thu	9/10	Classification	HW2 due · HW3 assigned
Tue	9/15	Clustering and dimensionality reduction	Mini-Project 1 assigned
Thu	9/17	Model validation II	HW3 due
Tue	9/22	Applications: quality prediction and predictive maintenance	
Thu	9/24	Module 1 consolidation	Mini-Project 1 due
Tue	9/29	Neural network fundamentals	
Thu	10/1	Backpropagation and gradient descent	HW4 assigned



Tue	10/6	Training loops in practice	
Thu	10/8	Overfitting and regularization	HW4 due · HW5 assigned
Tue	10/13	CNN fundamentals and transfer learning	Mini-Project 2 assigned
Thu	10/15	Sequence models: RNN and LSTM	HW5 due
Tue	10/20	Applications: visual defect detection and RUL prediction	
Thu	10/22	MID-TERM EXAM (Modules 1 and 2)	Mid-term Exam
Tue	10/27	Markov decision processes	Mini-Project 2 due
Thu	10/29	Q-learning	HW6 assigned · Mini-Project 3 assigned
Tue	11/3	No Class - INFORMS Conference	
Thu	11/5	Deep reinforcement learning	HW6 due · HW7 assigned
Tue	11/10	Applications: scheduling and inventory control	
Thu	11/12	Module 3 consolidation	HW7 due
Tue	11/17	Attention, and how large language models work	Mini-Project 3 due
Thu	11/19	LLM APIs, prompting and structured extraction	HW8 assigned
Tue	11/24	Retrieval-augmented generation and AI agents	
Thu	11/26	No Class - Thanksgiving	
Tue	12/1	Responsible AI and final project work session	HW8 due
Thu	12/3	Final project presentations	
Tue	12/8	FINAL EXAM (Modules 3 and 4)	Final report due

The course schedule, policies, procedures, and assignments in this course are subject to change in the event of extenuating circumstances, by mutual agreement, and/or to ensure better learning.