



COURSE OVERVIEW AI0020 **Artificial Intelligence (AI) and Machine Learning**

Course Title

Artificial Intelligence (AI) and Machine Learning

Course Date/Venue

December 07-11, 2025/TBA Meeting Room, The H Hotel, Sheikh Zayed Road Trade Centre, Dubai, UAE

Course Reference

AI0020

Course Duration/Credits

Five days/3.0 CEUs/30 PDHs

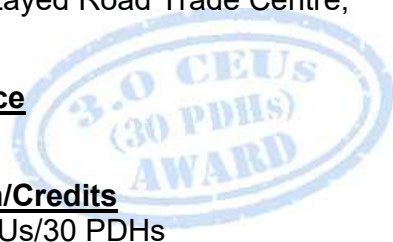
Course Description



This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

This course is designed to provide participants with a detailed and up-to-date overview of Artificial Intelligence (AI) and Machine Learning. It covers the differences between AI, ML and deep learning and its applications in engineering fields; the machine learning fundamentals, mathematical foundations for ML, data preparation and engineering and AI tools and platforms; the AI use cases in mechanical engineering covering predictive maintenance in rotating machinery, fault detection in pumps, compressors and turbines, energy optimization in HVAC and manufacturing and smart robotics and automation; the regression techniques, classification algorithms, model training and evaluation and applications in mechanical systems; the clustering techniques and dimensionality reduction; and the anomaly detection methods.

During this interactive course, participants will learn the reinforcement learning basics comprising of RL concepts and agents, Q-learning fundamentals, deep Q networks (DQN) and applications in robotics and control systems; the neural networks basics, activation functions and backpropagation, overfitting and regularization in deep learning and applications in image and signal processing; the deep neural networks (DNNs), computer vision applications, natural language processing (NLP) basics and AI in simulation and digital twins; the AI ethics and safety in engineering and AI for process optimization; the IoT and AI integration, edge versus cloud AI in manufacturing, cyber-physical systems and AI-enabled production lines; the AI-powered materials discovery, AI in additive manufacturing (3D printing) and autonomous maintenance robots; and the AI for sustainable engineering.



Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain an in-depth knowledge on artificial intelligence (AI) and machine learning
- Discuss the differences between AI, ML and deep learning and its applications in engineering fields
- Recognize machine learning fundamentals, mathematical foundations for ML, data preparation and engineering and AI tools and platforms
- Carryout AI use cases in mechanical engineering covering predictive maintenance in rotating machinery, fault detection in pumps, compressors and turbines, energy optimization in HVAC and manufacturing and smart robotics and automation
- Apply regression techniques, classification algorithms, model training and evaluation and applications in mechanical systems
- Carryout clustering techniques, dimensionality reduction and anomaly detection methods
- Discuss reinforcement learning basics comprising of RL concepts and agents, Q-learning fundamentals, deep Q networks (DQN) and applications in robotics and control systems
- Explain neural networks basics, activation functions and backpropagation, overfitting and regularization in deep learning and applications in image and signal processing
- Describe deep neural networks (DNNs), computer vision applications, natural language processing (NLP) basics and AI in simulation and digital twins
- Apply AI ethics and safety in engineering and AI for process optimization as well as discuss IoT and AI integration, edge versus cloud AI in manufacturing, cyber-physical systems and AI-enabled production lines
- Explain AI-powered materials discovery, AI in additive manufacturing (3D printing), autonomous maintenance robots and AI for sustainable engineering

Exclusive Smart Training Kit - H-STK®



*Participants of this course will receive the exclusive “Haward Smart Training Kit” (H-STK®). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of artificial intelligence (AI) and machine learning for senior mechanical engineers, IT professionals and software developers, data scientists and analysts, engineers and technical specialists, business analysts and strategists, project managers and consultants and other technical staff.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours

Certificate Accreditations

Haward's certificates are accredited by the following international accreditation organizations:

-  British Accreditation Council (BAC)

Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

-  The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.



Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:



Dr. Ahmed El-Sayed, PhD, MSc, BSc, is a **Senior Electromechanical Engineer** with over **30 years** of extensive experience in **Oil, Gas, Refinery, Petrochemical, Power and Utilities** industries. He specializes in **Artificial Intelligence (AI) & Machine Learning, Machine Learning & Data Analytics, AI, ML & Deep Learning, AI Tools & Platforms, Applications in Mechanical Systems, Steam Turbine Design, Performance, Operation, Maintenance & Troubleshooting, Mechanical Design of Centrifugal Compressors, Compressor Inspection, Maintenance, Overhaul & Repair, Fluid Flow & Rotating Machinery, Pumps, Valves, Boilers, Pressure Vessels, Heat Recovery Steam Generators (HRSG), Bearings, Compressors, Motors, Turbines, Actuators, Carbon Footprint, Energy Efficiency, Power Plant Performance & Efficiency, P&ID, Engineering Drawing, Codes & Standards and Hydraulic Systems**. He is currently the **Systems Control Manager** of **Siemens** where he is in-charge of Security & Control of power generation systems and he further takes part in the DCS implementation and commissioning.

During his career life, Dr. Ahmed has been actively involved in a variety of industrial activities including **Maintenance Planning & Scheduling, Reliability & Maintenance Management and Plant Shutdown & Turnarounds**. Moreover, he is an **authority** in vibration analysis, mechanical failure analysis, accident reconstruction, shock testing, measurement, analysis, calibration, ESS, HALT and HASS.

Dr. Ahmed is well-versed and conversant in the designed and applied automatic control systems using analogy instrumentation and computer-based control systems for a variety of industries with both analogue and discrete logic automatic control and implementation. Likewise, he is in-charge with troubleshooting and PID loop tuning of simple to complex systems installed and is involved in the design, implementation and documentation of emergency shut-down and safety instrumentation systems for a various processes especially for **hydraulics, steam turbines, gas turbines, boilers, heat recovery steam generators and large pumping systems**.

Dr. Ahmed has **PhD, Master's & Bachelor's** degree in **Electromechanical and Instrumentation Engineering** from the **University of Wisconsin (USA)**. Further, he is a **Certified Instructor/Trainer, a Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership and Management (ILM)** and has **numerous papers** published internationally in the areas of **superconductive magnetic energy storage (SMES)**, SMES role in power systems, power system blackout analysis, intelligent load shedding techniques for preventing power system blackouts and intelligent control of **boilers, heat exchangers and pumping systems**.



Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

- 30% Lectures
- 20% Practical Workshops & Work Presentations
- 30% Hands-on Practical Exercises & Case Studies
- 20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Fee

US\$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the workshop for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1: Sunday, 07th of December 2025

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 – 0930	Introduction to Artificial Intelligence History & Evolution of AI • Differences Between AI, ML & Deep Learning • Applications in Engineering Fields • AI Challenges & Opportunities for Mechanical Engineers
0930 – 0945	Break
0945 – 1030	Machine Learning Fundamentals Types of Learning (Supervised, Unsupervised, Reinforcement) • Data-Driven Decision Making • Training, Validation & Testing Concepts • Bias, Variance & Generalization
1030 – 1130	Mathematical Foundations for ML Linear Algebra Basics for AI Models • Probability & Statistics in ML • Optimization Concepts (Gradient Descent) • Cost Functions & Evaluation Metrics
1130 – 1215	Data Preparation & Engineering Data Collection in Mechanical Systems (Sensors, IoT) • Data Cleaning & Preprocessing • Feature Extraction & Scaling • Handling Missing & Noisy Data
1215 – 1230	Break



1230 – 1330	AI Tools & Platforms Overview Python for AI & ML • Popular ML Libraries (TensorFlow, PyTorch, Scikit-Learn) • AI Simulation Tools for Engineers (MATLAB, Ansys, COMSOL With AI Extensions) • Cloud-Based AI Services (AWS, Azure, Google AI)
1330 – 1420	AI Use Cases in Mechanical Engineering Predictive Maintenance in Rotating Machinery • Fault Detection in Pumps, Compressors, Turbines • Energy Optimization in HVAC & Manufacturing • Smart Robotics & Automation
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day One

Day 2: Monday, 08th of December 2025

0730 – 0830	Regression Techniques Linear Regression Fundamentals • Polynomial & Multivariate Regression • Regularization (Ridge, Lasso) • Applications in Mechanical System Modeling
0830 – 0930	Classification Algorithms Decision Trees & Random Forests • Support Vector Machines (SVM) • K-Nearest Neighbors (KNN) • Applications in Defect Classification
0930 – 0945	Break
0945 – 1100	Model Training & Evaluation Cross-Validation & K-Folds • Confusion Matrix & Accuracy Metrics • Precision, Recall & F1-Score • ROC Curves & AUC
1100 – 1215	Applications in Mechanical Systems Predicting Equipment Failures • Quality Inspection in Manufacturing • Remaining Useful Life (RUL) Estimation • Vibration & Thermal Analysis with ML
1215 – 1230	Break
1230 – 1330	Case Study: Predictive Maintenance Data Acquisition from Sensors • Feature Engineering for Time-Series Data • ML Model Development & Evaluation • Deployment in Industrial Systems
1330 – 1420	Hands-on Practical Session Build Regression & Classification Models in Python • Train with Real-World Engineering Datasets • Visualize Predictions & Error Metrics • Group Exercise: Fault Detection Modeling
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Two

Day 3: Tuesday, 09th of December 2025

0730 – 0830	Clustering Techniques K-Means Clustering • Hierarchical Clustering • Density-Based Clustering (DBSCAN) • Applications in Fault Grouping & Anomaly Detection
0830 – 0930	Dimensionality Reduction Principal Component Analysis (PCA) • t-SNE & LDA • Feature Selection vs Feature Extraction • Use in Mechanical Test Data Visualization
0930 – 0945	Break

0945 – 1100	Anomaly Detection Methods Statistical Anomaly Detection • Isolation Forests • Autoencoders for Anomaly Detection • Applications in Machinery Monitoring
1100 – 1215	Reinforcement Learning Basics RL Concepts & Agents • Q-Learning Fundamentals • Deep Q Networks (DQN) • Applications in Robotics & Control Systems
1215 – 1230	Break
1230 – 1330	Deep Learning Fundamentals Neural Networks Basics • Activation Functions & Backpropagation • Overfitting & Regularization in Deep Learning • Applications in Image & Signal Processing
1330 – 1420	Engineering Case Studies AI-Driven Process Optimization • Robotics in Assembly & Welding • Predictive Quality Assurance • Autonomous System Control
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Three

Day 4: Wednesday, 10th of December 2025

0730 – 0830	Deep Neural Networks (DNNs) Network Layers & Architectures • Convolutional Neural Networks (CNNs) • Recurrent Neural Networks (RNNs) • Applications in Mechanical Imaging
0830 – 0930	Computer Vision Applications Object Detection in Manufacturing • Defect Identification in Welding & Casting • Surface Quality Inspection • Thermal Imaging with CNNs
0930 – 0945	Break
0945 – 1100	Natural Language Processing (NLP) Basics Text Preprocessing & Embeddings • Sentiment & Classification Models • Applications in Engineering Reports Analysis • Voice-to-Command Interfaces in Robotics
1100 – 1215	AI in Simulation & Digital Twins Concept of Digital Twins in Engineering • AI-Based Predictive Simulations • Integration with CAD/CAE Tools • Energy & Cost Optimization
1215 – 1230	Break
1230 – 1330	Hands-On Deep Learning Workshop Build a CNN for Defect Detection • Train with Mechanical System Image Dataset • Model Evaluation & Deployment • Transfer Learning for Engineering Tasks
1330 – 1420	AI Ethics & Safety in Engineering Ethical Considerations in AI Adoption • Reliability & Robustness of AI Models • Cybersecurity & AI in Control Systems • Human-AI Collaboration in Engineering
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Four

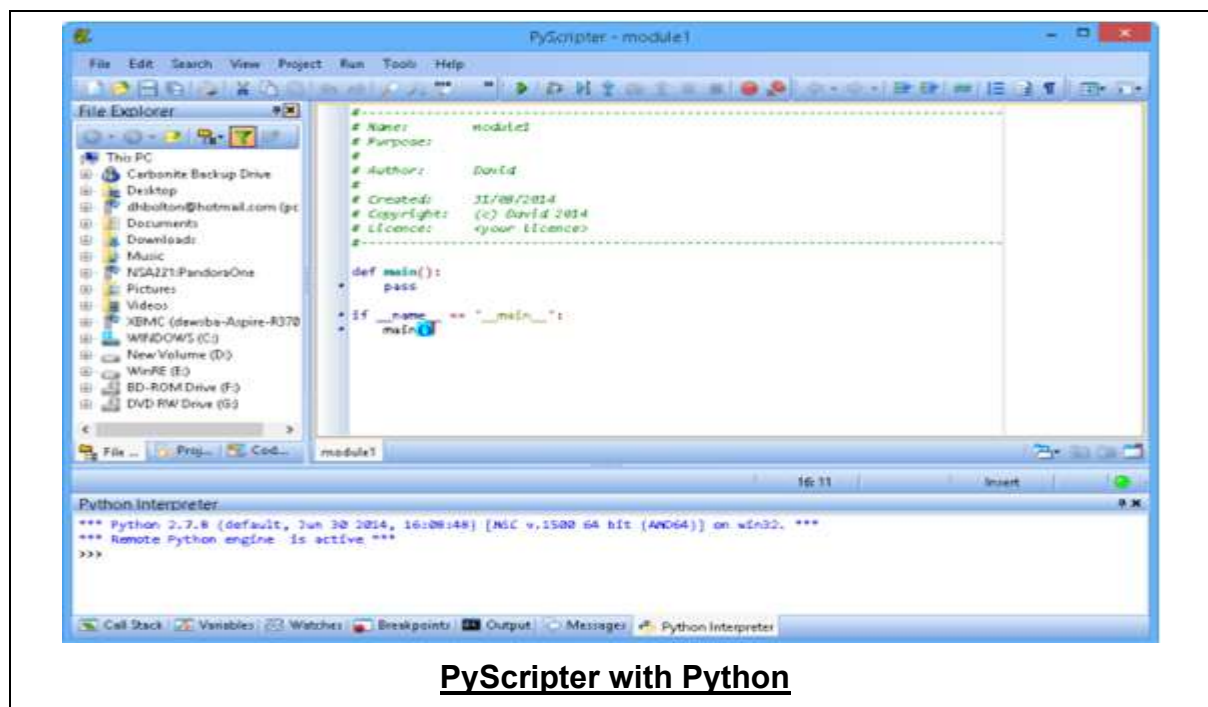


Day 5: Thursday, 11th of December 2025

0730 – 0830	AI for Process Optimization Lean Manufacturing & AI Integration • Predictive Scheduling & Resource Allocation • Energy Efficiency Optimization • AI in Supply Chain & Logistics
0830 – 0930	Mechanical System Case Studies Turbomachinery Fault Detection • Smart HVAC Optimization • Automotive Predictive Systems • Robotics & Autonomous Maintenance
0930 – 0945	Break
0945 – 1100	AI in Industry 4.0 & Smart Factories IoT & AI Integration • Edge versus Cloud AI in Manufacturing • Cyber-Physical Systems • AI-Enabled Production Lines
1100 – 1215	Future of AI in Mechanical Engineering AI-Powered Materials Discovery • AI in Additive Manufacturing (3D Printing) • Autonomous Maintenance Robots • AI for Sustainable Engineering
1215 – 1230	Break
1230 – 1345	Group Project & Presentation Define Engineering Problem with AI Solution • Select Appropriate ML/AI Approach • Develop Prototype Solution • Present Results & Recommendations
1345 – 1400	Course Conclusion Using this Course Overview, the Instructor(s) will Brief Participants about Topics that were Covered During the Course
1400 – 1415	POST-TEST
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course

Simulator (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using “PyScripter with Python” and “MS-Excel” application.



Course Coordinator

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