Introduction
The School of Engineering and Applied Science Online Programs offers the Doctor of Engineering (D.Eng.) degree in Artificial Intelligence and Machine Learning. Classes are held on Saturdays, starting in Fall 2023 with a target graduation date of Summer 2025. Applicants should normally hold a master’s degree in engineering, applied science, mathematics, computer science, or related field from an accredited institution.

The Doctor of Engineering in Artificial Intelligence & Machine Learning
A Doctor of Engineering (D.Eng.) in Artificial Intelligence & Machine Learning (AI & ML) is a research-focused doctoral degree program that aims to prepare graduates for leadership roles in industry and academia. This program is designed to provide students with a deep understanding of the latest AI and machine learning techniques, as well as hands-on experience in applying these techniques to real-world problems. Graduates of this program are equipped to lead AI and machine learning projects and teams in a wide range of industries, including healthcare, finance, manufacturing, and more. They are also well-prepared for academic research and teaching roles, as they will have developed advanced research skills and the ability to communicate complex ideas to a variety of audiences.

Curriculum
The curriculum comprises 24 credit hours of graduate level courses and a minimum of 24 credit hours of research during which the student writes and defends a praxis paper.

Proposed Program
- SEAS 8500 Fundamentals of AI-Enabled Systems (3 credit hours)
- SEAS 8505 Applied Machine Intelligence (3 credit hours)
- SEAS 8510 Analytical Methods for Machine Learning (3 credit hours)
- SEAS 8515 Data Engineering for AI (3 credit hours)
- SEAS 8520 Deep Learning and ML Operations (3 credit hours)
- SEAS 8525 NLP, Computer Vision and Reinforcement Learning (3 credit hours)
- SEAS 8550 Privacy and Organizational Issues in AI (3 credit hours)
- SEAS 8599 Praxis Development for AI (3 credit hours)
- SEAS 8588 Praxis Research for DEng in AI & ML (24 credit hour minimum)

Classroom Phase Schedule
Classroom courses last 10 weeks each and meet Saturday mornings from 9:00 am-12:00 pm and afternoons from 1:00-4:00 pm (all times Eastern). This program is taught in an accelerated, cohort format in which students take all courses in lock step. Courses cannot be taken out of sequence, attendance at all class meetings is expected, and students must remain continuously enrolled, i.e., leaves of absence are permitted only in the case of medical or family emergency, or deployment to active military duty.

<table>
<thead>
<tr>
<th>Session</th>
<th>#Courses</th>
<th>#Credit Hours</th>
<th>Session Dates</th>
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<tr>
<td>Fall-1 2023</td>
<td>2</td>
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<td>August 12 — October 14, 2023</td>
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<td>Fall-2 2023</td>
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<td>Spring-1 2024</td>
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<td>Spring-2 2024</td>
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<td>6</td>
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*No classes on Thanksgiving, Christmas, New Year, and Memorial Day Weekends*
Research Phase Schedule (Min. 24 Credit Hours)

In order to proceed to the research phase, students must earn a grade point average of at least 3.2 in the 8 classroom courses, and no grade below B-. Upon successful completion of the classroom phase, students are registered for a minimum of 24 credit hours (ch) of SEAS 8188 Praxis Research: 3 ch in Summer 2024, 9 ch in Fall 2024, 9 ch in Spring 2025, and 3 ch Summer 2025. Throughout the research phase, the student develops the praxis under the guidance of a designated faculty advisor. Faculty research advisors meet individually with students every two weeks.

Selected Research Areas for Praxis

With the advisor’s consent, the student focuses their research on an area within the Cybersecurity field. Some sample areas include:

- Developing algorithms and methods that can explain how AI systems reach their decisions or predictions, making them more transparent and trustworthy
- Investigating how reinforcement learning can improve robotic performance and control, particularly in complex environments
- Examining how to ensure that AI systems are fair and unbiased in their decision-making, particularly in areas such as hiring, lending, and criminal justice
- Developing more advanced natural language processing models and algorithms that can understand and interpret human language more accurately and effectively
- Investigating how to apply transfer learning techniques to improve the performance of AI systems in new and different domains, with less data and less training time

Tuition

All classes meet live online through synchronous distance learning technologies. Classes are recorded for future viewing. Tuition is $1750 per credit hour for the 2023-2024 year and is billed at the beginning of each semester for the courses registered during that semester. A non-refundable tuition deposit of $995, which is applied to tuition due the first semester, is required when the applicant accepts admission.

Course Descriptions

See also [http://bulletin.gwu.edu/courses/](http://bulletin.gwu.edu/courses/)


SEAS 8505 Applied Machine Intelligence: Theory and practice of machine learning leveraging open-source tools, algorithms and techniques. Topics include intelligent model training, support vector machines, deep learning, transformer methods, GANs and ensemble learning methods

SEAS 8510 Analytical Methods for Machine Learning: Mathematical tools for building machine learning algorithms: linear algebra, analytical geometry, matrix decompositions, optimization, probability and statistics

SEAS 8515 Data Engineering for AI: Developing python scripts to automate data pipelines, data ingestion, data processing, and data warehousing. Machine learning applications with Python including text mining and time series analysis


SEAS 8525 NLP, Computer Vision and Reinforcement Learning: Applications of modern deep learning methods in language, vision, and Reinforcement Learning. NLP models. Computer vision with an emphasis on Convolutional Neural Networks. Reinforcement Learning with an emphasis on actor critic methods

SEAS 8550 Privacy and Organizational Issues in AI: Technological basis of ethics in AI. Differentiating humans from machines in AI. Key topics in privacy and ethics of AI, including intrinsic bias and the significance of models. AI and individual responsibility. Addressing legal and regulatory issues

SEAS 8599 Praxis Development for AI: Overview of research methods. Aims and purpose of the praxis. Development of praxis research strategies, formulation and defense of a praxis proposal

SEAS 8588 Praxis Research for D.Eng. in AI and Machine Learning: Research leading to the degree of Doctor of Engineering in AI and Machine Learning

*The University reserves the right to adjust course offerings, schedules, and tuition rates.*