DOCTOR OF ENGINEERING IN ARTIFICIAL INTELLIGENCE & MACHINE LEARNING (ONLINE)

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 January 2024 with a target graduation date of January 2026. Applicants should typically hold a bachelor’s and a master’s degree in engineering, applied science, mathematics, computer science, or closely related fields from an accredited institution.

PROGRAM DESCRIPTION

The Doctor of Engineering (D.Eng.) in Artificial Intelligence & Machine Learning (AI & ML) is a research-based doctoral degree program that aims to prepare graduates for leadership roles in industry and academia. This program is designed to provide students with a solid understanding of the latest AI & ML techniques, as well as hands-on experience in applying these techniques to real-world problems. Graduates of this program are equipped to lead AI & ML projects and teams in a wide range of industries, including healthcare, finance, and manufacturing. 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 AND COURSES

The curriculum is comprised of a classroom phase of 24 credit hours of graduate level courses (see below):

- SEAS 6414 Python Application for Data Analytics (3 credit hours)
- SEAS 8500 Fundamentals of AI-Enabled Systems (3 credit hours)
- SEAS 8505 Applied Machine Intelligence & Reinforcement Learning (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 Natural Language Processing (3 credit hours)
- SEAS 8525 Computer Vision and Generative AI (3 credit hours)
- SEAS 8599 Praxis Development for AI (3 credit hours)

and a minimum of 24 credit hours of research during which the student writes and defends a research praxis:

- SEAS 8588 Praxis Research for D.Eng. 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). All classes meet live online through synchronous distance learning technologies. Classes are recorded for future viewing. This program is taught in an accelerated, cohort format in which students take all courses in lockstep. 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.

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<tr>
<th>Semester</th>
<th>Session</th>
<th>Credit Hours</th>
<th>Session Dates</th>
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<tbody>
<tr>
<td>Spring 2024</td>
<td>1</td>
<td>6</td>
<td>January 6—March 9, 2024</td>
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<td>2</td>
<td>6</td>
<td>March 23—June 1, 2024</td>
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<td>Summer 2024</td>
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<td>6</td>
<td>June 15—August 17, 2024</td>
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<td>Fall 2024</td>
<td>1</td>
<td>6</td>
<td>August 31—November 2, 2024</td>
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No classes on Thanksgiving, Christmas, New Year, and Memorial Day Weekends
**Research Phase Schedule**

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 8588 Praxis Research: 3 ch in Fall 2024, 9 ch in Spring 2025, 3 ch in Summer 2025, 9 ch in Fall 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 AI & ML 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**

Tuition is $1,750 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 Description**

- **SEAS 6414 Python Applications in Data Analytics**: Introduction to Python programming tailored for Data Analytics. This course covers Python's applications in automating data cleaning, feature engineering, outlier detection, implementing machine learning algorithms, conducting text mining, and performing time series analysis.
- **SEAS 8500 Fundamentals of AI-Enabled Systems**: Operational decomposition for AI solutions, engineering data for algorithm development, and deployment strategies. Systems perspective in designing AI systems. Full-lifecycle of creating AI-enabled systems. Ethics and biases in AI systems
- **SEAS 8505 Applied Machine Intelligence & Reinforcement Learning**: Theory and practice of machine learning leveraging open-source tools to explore the ideas, algorithms and techniques. Topics covered include intelligent model training, support vector machines, deep learning, transformer methods, GANs and reinforcement learning.
- **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 8520 Deep Learning and Natural Language Processing**: Fundamentals of deep learning and natural language processing (NLP). Techniques for designing modern deep learning networks using Keras and Tensorflow. NLP topics including sentiment analysis, bag of words, TFIDE large language models.
- **SEAS 8525 Computer Vision and Generative AI**: Explore AI's visual realm. Learn image processing, object detection, and generative models in Generative Adversarial Network and neural networks. Master tools for creative AI applications in art, design. Ethical considerations and societal impacts of generative AI technology.
- **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

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

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