

Course Change Request

New Course Proposal

Date Submitted: 03/13/26 12:14 pm

Viewing: **COS 503 : Introduction to AI Applications in Science**

Last edit: 03/13/26 12:14 pm

Changes proposed by: jbazaz

In Workflow

1. SC Curriculum Committee
2. SC Assistant Dean
3. Assoc Provost-Graduate
4. Registrar-Courses
5. Banner

Are you completing this form on someone else's behalf?

Yes

Requestor:

Name	Extension	Email
Arie Croitoru	5302	acroitor@gmu.edu

Effective Term: Summer 2026

Subject Code: COS - College of Science

Course Number: 503

Bundled Courses:

Is this course replacing another course? No

Equivalent Courses:

Catalog Title: Introduction to AI Applications in Science

Banner Title: Intro to AI Application in Sci

Will section titles vary by semester? No

Credits: 3

Schedule Type: Lecture

Hours of Lecture or Seminar per week: 3

Repeatable: May only be taken once for credit (NR)
GRADUATE ONLY

Default Grade Mode: Graduate Regular

**Recommended
Prerequisite(s):**

**Recommended
Corequisite(s):**

**Required
Prerequisite(s) /
Corequisite(s)
(Updates only):**

Registrar's Office Use Only - Required Prerequisite(s)/Corequisite(s):

And/Or	(Course/Test Code	Min Grade/Score	Academic Level)	Concurrency?

**Registration
Restrictions
(Updates only):**

Registrar's Office Use Only - Registration Restrictions:

Field(s) of Study:

Class(es):

Level(s):

Degree(s):

School(s):

Catalog

Description:

This course explores how artificial intelligence (AI) is transforming scientific research across the natural, mathematical, computational, and data sciences through a critical examination of the research literature. Students will review and analyze peer-reviewed studies demonstrating AI applications in these and other scientific fields while developing expertise in evaluating and synthesizing AI-driven research. Each week focuses on a scientific domain, with students learning to identify, synthesize, and critically evaluate the AI methods employed by researchers in that field. The course emphasizes conceptual understanding of AI approaches, ethical considerations in AI-driven research, and the ability to conduct rigorous literature reviews that contextualize AI methods within scientific problems. No programming is required.

Justification:

What: Creating a new course.

Why: To offer a course focusing on scientific AI applications.

Does this course cover material which crosses into another department? No

Learning Outcomes:

Will this course be scheduled as a cross-level cross listed section?

Attach Syllabus

[COS_503_syllabus_03122026.pdf](#)

Additional Attachments

[COS_303_syllabus_03122026.pdf](#)

Staffing:

Dr. Billy Lamberti with guest lectures from COS departmental faculty.

Relationship to Existing Programs:

Currently none.

Relationship to Existing Courses:

Will be crosslisted with a new course, COS 303.

Have you reached out to the Libraries to determine whether there are adequate resources to support your course? If not, please email Meg Meiman, Associate University Librarian for Learning, Research, and Engagement at mmeiman2@gmu.edu.

No

Additional Comments:

Reviewer Comments

COS 503: AI Applications in Science

Course Title: Introduction to AI Applications in Science
Course Number: COS 503
Prerequisites: None
Credits: 3
Semester: Fall 2026

Instructor: Dr. Billy Lamberti
Meeting schedule: TBD
Modality: In-person
Location: TBD
Contact Information: wlamber2@gmu.edu
Office hours: TBD

Course Description/Overview:

This course explores how artificial intelligence (AI) is transforming scientific research across the natural, mathematical, computational, and data sciences through a critical examination of the research literature. Students will review and analyze peer-reviewed studies demonstrating AI applications in these and other scientific fields while developing expertise in evaluating and synthesizing AI-driven research. Each week focuses on a scientific domain, with students learning to identify, synthesize, and critically evaluate the AI methods employed by researchers in that field. The course emphasizes conceptual understanding of AI approaches, ethical considerations in AI-driven research, and the ability to conduct rigorous literature reviews that contextualize AI methods within scientific problems. No programming is required.

Course Learning Outcomes: Upon successful completion of this course, students will be able to:

- Define AI, distinguish between major AI subfields, and identify common approaches used in scientific research endeavor.
- Evaluate the appropriateness of AI methods for addressing specific scientific problems in the natural, mathematical, computational, and data sciences.
- Analyze the impact of AI on research methodologies across scientific disciplines.
- Critically examine ethical, societal, and bias-related issues in the use of AI for scientific research.
- Critically evaluate claims, methods, and evidence in published AI research.
- Synthesize results across studies to identify trends, gaps, and emerging directions in AI-enabled science.
- Communicate advanced AI concepts and research findings clearly to non-technical scientific audiences using frameworks for explainability and interpretability.

Textbook and course materials: No textbook is required. Students will receive curated readings and class resources each week. Domain-specific peer-reviewed articles will be assigned each week, demonstrating AI applications in each scientific field. Students will also identify and analyze additional literature as part of their assignments.

Hardware: a working computer with internet access.

Software: A supported up-to-date web browser ([check your browser is compatible with Canvas](#)) and Microsoft 365 (free for Mason students, please refer to [these details](#) for additional information). No additional specialized software is required. Students will interact with publicly available AI tools through web interfaces (e.g., Patriot AI). All tools used will be freely accessible.

Teaching Methods: The course will be delivered through a combination of the following methods:

- Lectures and discussions led by course instructor and guest faculty
- In-class demonstrations of AI tools and applications
- Small group activities and problem-solving exercises
- Video case studies showcasing real-world AI applications
- Guided exploration of publicly available AI tools (no programming required)
- Student presentations

Grading and Course Policies

Grading Schema: Grades are determined using point values and the following formula:

$$\text{Grade} = (\text{Points Earned} + \text{Extra Credit}) / (\text{Points Available})$$

The table converting points to letter grades is provided below:

Points Range	Letter Grade
211–220	A+
198–210	A
193–197	A-
187–192	B+
176–186	B
171–175	B-
165–170	C
<165	F

Grade Weights:

Item	Points (weight)
Literature Reviews (4)	92
Critical reading exercises (submit 6 of 9)	18
Literature Synthesis I	44
Literature Synthesis II	66
Total	220

Literature Review Assignments (4, 22 points each): each assignment requires students to:

- Identify 3 peer-reviewed articles demonstrating AI applications
- Summarize the AI methods used in each study at a conceptual level
- Compare approaches across studies
- Evaluate the appropriateness and transparency of methods

- Identify gaps or limitations in current applications

Literature Synthesis I (44 points): Students select a scientific domain (may be their own field of study) and conduct a focused literature review:

- **Focus:** Synthesize how AI is being applied, identify common methods, and evaluate the state of the field (see description in Week 8)
- **Scope:** 5-6 peer-reviewed sources
- **Written report:** 5-7 pages
- **Oral presentation:** 10-12 minutes presented during Week 8

Literature Synthesis I Rubric

Component	Points	Criteria
Research Question & Scope	6	Clear, focused question; appropriate scope for mini review
Literature Search	6	Systematic approach documented; appropriate sources identified
Method Descriptions	10	AI methods accurately described at conceptual level
Synthesis & Analysis	12	Patterns identified across studies; critical evaluation present
Presentation	10	Clear delivery; accessible explanation of technical concepts
Total: 44		

Literature Synthesis II (88 points): A comprehensive systematic literature review on AI applications in a scientific area:

- **Scope:** 8-10 peer-reviewed sources
- **Written report:** 15–20 pages
- **Oral presentation:** 15–20 minutes presented during Week 14/15
- **Requirements:**
 - Clear research question guiding the review
 - Systematic search methodology documented
 - Conceptual description of AI methods encountered
 - Synthesis of findings across studies
 - Critical evaluation of the field's use of AI
 - Identification of trends, gaps, and future directions
 - Discussion of ethical and interpretability considerations

Literature Synthesis II Rubric

Component	Points	Criteria
Introduction & Research Question	12	Clear motivation; well-defined scope; significance established
Search Methodology	10	Systematic approach; databases and criteria documented
Conceptual Framework	14	AI methods accurately categorized and described
Synthesis of Findings	20	Themes identified; studies compared; patterns analyzed
Critical Evaluation	16	Strengths/limitations assessed; interpretability considered
Conclusions & Future Directions	8	Gaps identified; implications discussed
Presentation	8	Professional delivery; handles questions well
Total: 88		

Communication expectations for graduate students: graduate students enrolled in this course are expected to demonstrate mastery at a level appropriate for advanced study:

- **Writing quality:** all written work should meet the standards of academic publication, with clear prose, logical organization, and proper citation (APA or discipline-appropriate style).
- **Depth of analysis:** reviews should go beyond description to offer critical evaluation, identifying methodological strengths and weaknesses in the literature.
- **Conceptual precision:** students should accurately describe AI methods using appropriate terminology, even without implementation experience.
- **Synthesis skills:** the ability to identify patterns, contradictions, and gaps across multiple studies is essential.
- **Presentation skills:** presenters should communicate complex technical concepts accessibly and handle questions professionally.

Grading-related Policies: TBD

Email communication: Students must monitor their Mason email account regularly, and use it to send/receive University information, including communications related to this class. We cannot respond to messages sent from a non-Mason email account. Email messages received Monday through Friday during regular business hours will be answered within 24 hrs. Messages received during weekends or university-observed holidays will be answered on the following business day. Efficient and professional communication is important when contacting the course team. For information and tips on this subject please review the following resource: [Sending Email to Faculty and Administrators](#). Please also refer to the “FERPA and Use of GMU Email Addresses for Course Communication” section in the GMU Common Course Policies section for additional details.

GMU Common Course Policies

Students in this course are required to familiarize themselves with GMU’s Common Course Policies at <https://stearnscenter.gmu.edu/home/gmu-common-course-policies/>

Use of AI Tools in this course: Use of various AI tools is required in this course. Students will interact with publicly available AI tools through web interfaces (e.g., Patriot AI). Throughout the course, students may be asked to self-report, reflect on, and critique their use of AI tools, as well as collect information related to their AI activities.

Important Dates: please refer to the Office of the University Registrar for information about the Fall 2026 Academic Calendar: https://registrar.gmu.edu/calendars/fall_2026/. The final exam schedule for that semester is available at: <https://registrar.gmu.edu/wp-content/uploads/Final-Exams-202570.pdf>

Weekly Course Schedule

Week 1: Introduction to AI and Course Overview

- What is artificial intelligence? Definitions and historical context
- Overview of current trends in AI: machine learning, deep learning generative AI, natural language processing, computer vision, robotics
- How AI differs from traditional computational approaches
- Course structure and expectations
- Introduction to the College of Science departments and disciplines

Week 2: Foundations of Machine Learning (Conceptual Overview)

- The machine learning paradigm: learning from data
- Supervised vs. unsupervised learning: key distinctions
- Training, validation, and testing: why it matters
- Overfitting and generalization in plain language
- **Self-study Module:**
 - Framework for conducting literature reviews of AI research
 - AI-assisted scientific literature review
 - How to read a methods section: identifying the ML approach used

Week 3: Ethics of AI in Science

- Foundational principles of ethics in scientific research
- Bias in AI systems: sources, consequences, and mitigation strategies
- Data privacy and consent in AI-driven research
- Reproducibility and transparency in AI-assisted science
- Responsible AI development and deployment
- Case studies: ethical failures and successes in scientific AI applications
- **Critical reading exercise:** ethical failures and successes in scientific AI applications
- **Self-study Module:**
 - Interpretability and trade-offs between accuracy and interpretability
 - Framework for assessing transparency in AI research
 - AI-assisted scientific writing

Week 4: AI in Computational and Data Sciences

- **Guest Lecturer(s):** the Computational and Data Sciences Faculty
- Introduction to Computational and Data Sciences
- Machine learning fundamentals and workflows
- Big data analytics and AI
- High-performance computing for AI applications
- AI applications in modeling and simulation
- **Assignment:** Literature Review 1 assigned (due Week 6)
- **Critical reading exercise:** evaluating AI in big data analytics studies

Week 5: AI in Biology, Bioinformatics, and Computational Biology

- **Guest Lecturer(s):** Biology Department Faculty
- AI applications in genomics, bioinformatics and medicine
- Protein structure prediction (AlphaFold and related tools)
- Species identification and biodiversity monitoring
- Exploring Evolutionary and Ecological Data/modeling
- Drug discovery and development
- Current biology research at GMU utilizing AI
- **Critical reading exercise:** AI in biology, bioinformatics, and computational biology research

Week 6: AI in Chemistry and Biochemistry

- **Guest Lecturer(s):** Chemistry and Biochemistry Department Faculty
- **Assignment:** Literature Review 1 due
- AI in molecular modeling and simulation
- Predicting chemical properties and reactions
- AI-assisted drug design and materials discovery
- Spectroscopy analysis using machine learning

- Laboratory automation and AI
- Current chemistry research at GMU utilizing AI
- **Critical reading exercise:** AI in chemistry and biochemistry research

Week 7: AI in Physics and Astronomy

- **Guest Lecturer(s):** Physics and Astronomy Department Faculty
- **Assignment:** Literature Review 2 assigned (due Week 9)
- AI in particle physics and high-energy experiments
- Gravitational wave detection and analysis
- Cosmological simulations and AI
- Quantum computing and AI intersections
- AI for experimental data analysis
- Current physics research at GMU utilizing AI
- **Critical reading exercise:** AI in physics and astronomy research

Week 8: Project: Literature Synthesis I

- **Literature Synthesis I:** students will identify, select, and synthesize scholarly literature on the use of artificial intelligence in a scientific field of their choice to produce a critical literature review. In this assignment, students will collect and examine 5-6 relevant research papers from various reputable sources, analyze from these papers how AI is being applied within the field, and evaluate the quality, purpose, and implications of these applications. They will also integrate their understanding of AI conceptual foundations and appraise aspects of ethics, accuracy, and transparency across the literature
- Deliverables include a written report and a class presentation

Week 9: AI in Earth Sciences

- **Guest Lecturer(s):** Environmental Science and Policy Faculty, Atmospheric, Oceanic & Earth Sciences Faculty
- **Assignment:** Literature Review 3 (due Week 11), Literature Review 2 due
- Critical reading exercise: evaluating environmental AI studies
- Climate modeling and prediction using AI
- Wildlife tracking and conservation applications
- Air and water quality monitoring
- Sustainable resource management with AI
- Current environmental science research at GMU utilizing AI
- **Critical reading exercise:** AI in earth sciences research

Week 10: AI in Neuroscience

- **Guest Lecturer(s):** Neuroscience Department Faculty
- **Assignment:** Literature Review 3 (due Week 12), Literature Review 2 due
- Brain imaging analysis with AI
- Neural signal processing and brain-computer interfaces
- Computational models of cognition
- AI in mental health diagnostics and treatment
- Connectomics and neural network mapping
- Current neuroscience research at GMU utilizing AI
- **Critical reading exercise:** AI in neuroscience research

Week 11: AI in Mathematical Sciences

- **Guest Lecturer(s):** Mathematical Sciences Department Faculty
- The mathematical foundations of AI

- Optimization methods in AI
- Harnessing AI to advancing mathematical sciences
- Current mathematical sciences research at GMU utilizing AI
- **Critical reading exercise:** AI in mathematical science research

Week 12: AI in Forensic Science

- **Guest Lecturer(s):** Forensic Science Program Faculty
- **Assignment:** Literature Review 4 (due Week 14), Literature Review 3 due
- AI in forensic DNA analysis
- Pattern recognition: fingerprints, facial recognition, ballistics, evidence collection and analysis
- AI in forensic toxicology
- Legal and ethical considerations unique to forensic AI: legal considerations and challenges in federal and state courts re: expert scientific testimony and AI
- Current forensic science research at GMU utilizing AI
- **Critical reading exercise:** AI in Forensic science research and practice

Week 13: AI in Geography and Geoinformation Science

- **Guest Lecturer(s):** Geography and Geoinformation Science Department Faculty
- Geographic Information Systems (GIS) and AI integration
- Spatial data analysis and machine learning
- Urban planning and smart cities
- Natural disaster prediction and response
- Remote sensing and satellite image analysis
- Current GIS research at GMU utilizing AI
- **Critical reading exercise:** AI in Geoinformation Science research

Week 14/15: Project - Literature Synthesis Project II

- **Assignment:** Literature Review 4 due
- **Literature Synthesis Project II:** Building on Literature Synthesis Project I (Week 8), students will identify, collect, and synthesize scholarly literature on the use of artificial intelligence across scientific domains, moving beyond a single field to integrate and compare how AI is applied in varied research contexts. The central emphasis of this assignment is for students to detect cross-cutting themes, analyze recurring methodological patterns, and evaluate how different disciplines frame the opportunities and limitations of AI. In addition, students will develop and propose best practices for communicating AI research to diverse audiences by adapting key findings, concerns, and implications for both specialist and non-specialist readers.
- Deliverables include a written report and a class presentation