

**UNIVERSITY OF MICHIGAN**  
**College of Engineering**  
**Curriculum Committee Meeting**  
**Tuesday, April 4, 2023**

**Attending:** Xiaogan Liang (Chair), Robert Bordley, Yavuz Bozer, Andrew DeOrio, Jessy Grizzle, Roman Hryciw, Xianzhe Jia, Leena Lalwani, Kathellen Panagis, Ken Powell, Eric Rutherford, Rachael Schmedlen, Katie Snyder, Roxanne Walker, Steven Yalisove, Won Sik Yang

**Support Staff:** Stacie Benison, Mercedes Carmona, Betsy Dodge, Matthew Faunce

**Call to Order: 1:36pm**

**Adjourned: 2:07pm**

**AGENDA**

1. Approval of 3.21.2023 Meeting Minutes (Page 2) - **APPROVED**
2. Aerospace Concentration in Robotics – Action Item (Page 4) - **APPROVED**
  - a. Adding a concentration as autonomy has always played a large role in aerospace engineering. There has been high interest from Aerospace students in Robotics.
    - i. Concentration to be implemented for Fall 2023. The requirements listed have been created and adhere to the policy for Engineering Concentrations.
      1. 12+ credits are required, only technical and general electives can be used
      2. Up to three research credits can count towards a concentration with Program Advisor pre-approval
      3. Courses must be letter graded and cannot be taken for Pass/Fail
      4. Not available to students pursuing dual degrees or SUGS masters in the same area per policy for concentrations
      5. C- or better for all courses and GPA must be 2.0 and above
    - ii. 1 linear algebra course (Choices in ROB, AERO, MATH), 1 Core AERO Robotics course, and 2 more courses from Robotics, Dynamics and Control, and/or Math, Computation, Machine Learning, and Data-Drive Modeling.
  - b. A question was raised as to why SUGS students cannot take this concentration and was explained that the concentration is adhering to the Engineering Concentration policy and Rackham Rules, which excludes SUGS students.
  - c. Letter grading will need to be reviewed for a requirement as S and U courses can fall into this category and the concentration may not want these courses included.
    - i. Suggestion to revise grading requirement as Letter Grading (A-E) if they wish not to include S and U courses.
  - d. Ken states he will follow up and double check the concentration policy to make sure everything is thorough with the questions raised.

**CARF SUMMARIES**

<b>PAGE</b>	<b>SUBJECT</b>	<b>COURSE #</b>	<b>ACTION</b>	<b>SUMMARY</b>	<b>EFFECTIVE TERM</b>	<b>MIN. GRADE REQ. FOR ENF. PREPREQ</b>	<b>APPROVED</b>	<b>NOTES &amp; REVISIONS</b>	<b>TABLED</b>
7	CSE	543	NEW		WT 2024	NO	CONDITIONAL APPROVAL	Consider adding Undergraduate credit and review both Advisory and Enforced Prerequisite.	
32	ECS	402	MOD	Changes to Course Description and Enforced Prerequisite	WT 2024	NO	CONDITIONAL APPROVAL	Obtain Home Department Chair signature.	
35	MATSCIE	281	NEW		WT 2024	NO	CONDITIONAL APPROVAL	Cross listed with ANTHRARC 281. Update Course Description to 46-word version.	

**UNIVERSITY OF MICHIGAN**  
**College of Engineering**  
**Curriculum Committee Meeting**  
**Tuesday, March 21, 2023**

**Attending:** Xiaogan Liang (Chair), Robert Bordley, Yavuz Bozer, Annouck Girard, Roman Hryciw, Xianzhe Jia, Amir Kamil, Leena Lalwani, Yulin Pan, Kathleen Panagis, Ken Powell, Eric Rutherford, Rachael Schmedlen, Katie Snyder, Roxanne Walker, Steven Yalisove, Won Sik Yang

**Support Staff:** Stacie Benson, Mercedes Carmona, Betsy Dodge, Matt Faunce

**Call to Order: 1:34 PM**

**Adjourned: 2:20 PM**

**AGENDA**

1. Approval of 3.7.2023 Meeting Minutes (Page 2) - **APPROVED**
2. Robotics Undergraduate Program Modification -Action Item (Page 4) – **APPROVED**
  - a. The Robotics Undergraduate Program has modifications to be made for the following 2023-2024 academic year which are:
    - i. Renaming our Kinematics and Dynamics Discipline Depth to Dynamics and Mechanics
    - ii. Moving MECHENG 360 from our Kinematics and Dynamics requirement to Flexible Technical
      1. MECHENG 240 is one of the courses which satisfies the programs Kinematics and Dynamics section of the Discipline Breadth Requirement. MECHENG 240 is an enforced pre-req from MECHENG 360, which means students would not be able to enroll in MECHENG 360 without having completed MECHENG 240. This is the reason in which MECHENG 360 needs to be moved to a Flexible Technical elective.
    - iii. Adding 400-Level PHYSICS courses as Flexible Technical Electives
  - b. All changes will be reflected to students and the modifications made will better reflect what this program has to offer.
3. Updated Y-Grading Policy from the RO Curriculum Office – Informational Item (Page 6)
  - a. Lisa Emery - Senior Associate Registrar - from the RO Curriculum Office has notified the CoE Registrar Office regarding Y-grading that: “students should receive credit in the same term that the course work is being done,” as U of M wants to move away from the Y-Grading altogether.
  - b. The RO Curriculum Office recognized the rare instances in which Y-Graded classes registration was in the Fall and grades weren’t finalized until Winter. The preferred set up is to have half of the credits in the first term, the other half of the credits set up for the following term and make the course repeatable for the total number of credits for the course.
  - c. Discussions are currently ongoing as to what this means for current classes as there are a lot of CoE courses, such as graduate and capstone courses, that will be affected if there were a change to be implemented to Y-Grading. As of now, per Betsy, there will be no changes to past courses and only new courses will implement the change of no grading basis of Y-Grading.
  - d. A question was raised about modifications and how that is affected by Y-Grading. Course modifications can be made, but not to change the course grading basis to Y-Grading as the university is moving away from this grading system as much as possible.
  - e. The RO Curriculum Office will continue discussions with Y-Grading with current courses as there will be other factors to consider such as federal and state requirements and funding. Betsy will keep the CCC updated with any official changes made regarding Y-Grading and current courses.
4. CCC Meeting Schedule for 2023-2024 Academic Year Final – Informational Item (Page 7) - **APPROVED**
  - a. The CCC Meeting Schedule for the next school year was approved by CoE leadership, Lola and Kevin’s office.
  - b. Future discussions will be had for the next academic school year, 2024-2025, as there should be consideration to move the meeting date from Tuesday to another day during the week if possible, for those that teach or have other conflicts with the current Tuesday meeting day.

5. LSA/CoE Joint Meeting Cancelled. In place of that meeting, there will be one more CCC meeting on April 4 from 1:30-3PM.
- a. Does the CCC want to weigh in/discuss the divergent declaration requirements between departments?
    - i. The committee said that they did want to explore this further and agreed that it will be discussed at the next meeting.

**CARF SUMMARIES**

PAGE	SUBJECT	COURSE #	ACTION	SUMMARY	EFFECTIVE TERM	MIN. GRADE REQ. FOR ENF. PREPREQ	APPROVED	NOTES & REVISIONS	TABLED
8	BIOMEDE	502	NEW		FT 2024	NO	CONDITIONAL APPROVAL	Reword Course Description so it is specific to BME Ph.D. students to ensure master's students. Graduate standing in Biomedical Engineering Who is intended audience? Wording needs to reflect intended audience.	
33	BIOMEDE	517	MOD	Changes to Course Description, Course Credit Type, Enforced Prerequisite, Course Components	WT 2024	B	CONDITIONAL APPROVAL	Remove Advisory Prerequisite. Change last sentence of course description to, "Students then apply machine learning"  May be useful to add EECS 280 to list of programming courses in Enforced Prerequisite.	
36	KINESLGY	533	MOD	Changes to Course Description, Advisory and Enforced Prerequisites	WT 2024	NO	APPROVED	Cross listed with BIOMEDE 533.  If both schools agree to allow credit for undergraduate students in the future, both schools should submit a future CARF requesting this change to their Curriculum Committees.	



Kenneth G. Powell  
Arthur F. Thurnau Professor  
Undergraduate Program Advisor, Aerospace Engineering

Department of Aerospace Engineering  
1320 Beal Avenue  
Ann Arbor, Michigan 48109-2140  
734 764-3331 Phone  
powell@umich.edu

*The University of Michigan*

April 3, 2023

College of Engineering Curriculum Committee

The Aerospace Engineering Department would like to insititute a Concen-  
tration in Robotics. This Concentration was developed by Prof. Anouck  
Girard (Program Advisor of Robotics and Undergrad Chair of Aero), Prof.  
Chad Jenkins (Undergrad Chair of Robotics) and myself (Program Advisor  
of Aero). It was approved by the Aero faculty with 26 yes votes 4 abstentions.

We are requesting a start date of Fall 2023.

The requirements for the concentration are listed on the attached document.  
They adhere to the policy for Engineering Concentrations:

- 12+ credits are required.
- Only technical and general electives are used.
- Up to three research credits in a related area can count towards a concentration with Program Advisor pre-approval.
- Courses taken for the concentration cannot be taken Pass/Fail
- The concentrations are not available to students pursuing dual degrees or SUGS masters in Aeropace.
- Students mut earn a C- or better in all courses counting towards a concentration and must earn a 2.0 or above overall concentration GPA.

All the best,

A handwritten signature in blue ink that reads 'K. G. Powell'.

Kenneth G. Powell, Program Advisor

## CONCENTRATIONS WITHIN THE AERO PROGRAM

AERO concentrations consist of 12+ credits. Only technical and general electives can be used as part of a concentration. Up to three research credits in a related area can count towards a concentration with Program Advisor pre-approval. Courses taken for a concentration cannot be taken Pass/Fail. Concentrations are not available to students pursuing dual degrees or SUGS masters in the same area. Student must earn a C- or better in all courses counting towards a concentration and must earn a 2.0 or above overall concentration GPA.

### Concentration in Aerospace Robotics for AERO Engineering Majors 12+ credits

#### A. 1 linear algebra course: Choose one course among the following linear algebra courses:

ROB 101 Computational Linear Algebra (4cr)  
Math 214 Applied Linear Algebra (4 cr, Math 116)  
Math 217 Linear Algebra (4 cr, Math 215)  
Math 419 Linear Spaces and Matrix Theory (3 cr, 4 math courses beyond Math 110)  
AERO 550 Linear Systems Theory (4 cr, graduate standing or permission of instructor)

#### B. 1 Core AERO Robotics course: Choose one course among the following:

AEROSP 540 (MECHENG 540) Intermediate Dynamics (3 cr, MECHENG 240)  
AEROSP 548 Astrodynamics (3 cr, AEROSP 343 or graduate standing (Advisory))  
AEROSP 552 Aerospace Information Systems (3 cr, AEROSP 350, Advised Prerequisite: ENGR 101 and MATH 216 or graduate standing)  
AEROSP 573 Dynamics and Control of Spacecraft (3 cr, AEROSP 470 or graduate standing (Advisory))  
AEROSP 575 Flight and Trajectory Optimization (3 cr, AEROSP 470 or graduate standing (Advisory))  
AEROSP 580 Linear Feedback Control Systems (3 cr, Advisory Prerequisite: AEROSP 550 (Credit for both AEROSP 580 and EECS 565 not allowed.))  
AEROSP 584. Avionics, Navigation and Guidance of Aerospace Vehicles (3 cr, AEROSP 470 or graduate standing (Advisory))

#### C. Choose any of the remaining credits from any of the following specialization courses:

##### Robotics:

Any ROB 4xx course (excluding ROB450 capstone design)  
Any ROB 5xx course (excluding ROB550 lab)

##### Dynamics and Control:

Any Core AERO course not already used  
AEROSP 543 Structural Dynamics (3 cr, AEROSP 315 or AEROSP 540)  
AEROSP 545 Aeromechanics of Rotary Wing Vehicles (3 cr, AEROSP 315 and 325)  
ME 543 Analytical and Computational Dynamics (3 cr, ME 440)  
ME 560 Modeling Dynamic Systems (3 cr, ME 360)  
ME 561 Design of Digital Control Systems (3 cr, ME 461)  
ME 567 Robot Kinematics and Dynamics (3 cr, instructor permission)

**Math, Computation, Machine Learning, and Data-Driven Modeling:**

AEROSP 566. Data Analysis and System Identification (3 cr, graduate standing)

AEROSP 567. Inference, Estimation, and Learning (3 cr)

ME 499 Introduction to Computation and Machine Learning for Engineering (3 cr, Math 216)

ME 599 Computational and Data-Driven Methods in Engineering (3 cr, no pre-req)

**Other courses:**

AEROSP 423 Computational Methods for Aerospace Engineering (3cr, ENGR 101 or ENGR 151, MATH 216, and AEROSP 350 w/ minimum grade of C-)

AEROSP 588 Multidisciplinary Design Optimization (3 cr, MATH 419 or equivalent, MATH 371 or equivalent, graduate standing)

EECS 464 Hands-on Robotics (4 cr, ME 360)

BME 517 Neural Engineering (3 cr, EECS 216)

EECS 460 Embedded Control Systems (4 cr, EECS 216)



# Course Approval Request Form

Office of the Registrar, University of Michigan

1210 LSA Building  
500 S. State Street  
Ann Arbor, MI 48109-1382  
Phone: 734.763.2113  
Fax: 734.936.3148  
ro.curriculum@umich.edu  
ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

### Action Requested

- New Course  
 Modification of Existing Course  
 Deletion of Existing Course
- Date of Submission: 2023-03-06  
Effective Term: Winter 2024

<input checked="" type="checkbox"/>	Course Offered <input checked="" type="checkbox"/> Indefinitely <input type="checkbox"/> One term only	<b>RO USE ONLY</b> Date Received: Date Completed: Completed By:
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### CURRENT LISTING

### REQUESTED LISTING

<input checked="" type="checkbox"/>	Dept (Home): Subject: Catalog:	Dept (Home): Computer Science and Engineering Subject: CSE Catalog: 543												
<input type="checkbox"/>	<input type="checkbox"/> Course is Cross-Listed with Other Departments	<input type="checkbox"/> Course is Cross-Listed with Other Departments												
<input type="checkbox"/>	<table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	Department	Subject	Catalog Number				<table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>	Department	Subject	Catalog Number			
Department	Subject	Catalog Number												
Department	Subject	Catalog Number												
<input checked="" type="checkbox"/>	Course Title (full title)	Course Title (full title) Ethics for AI and Robotics												
<input checked="" type="checkbox"/>	Abbreviated Title (20 char)	Abbreviated Title (20 char) Ethics AI & Robotics												
<input checked="" type="checkbox"/>	Course Description (Please limit to 50 words and attach separate sheet if necessary) Ethical issues raised by AI and Robotics. Foundations in philosophical ethics and game theory; trust, cooperation, and the well-being of society; safety and autonomous vehicles; privacy and surveillance; fairness and bias; jobs and economic inequality; regulation of AI. Class discussions, literature review, and final term paper.													
<input checked="" type="checkbox"/>	Full Term Credit Hours Undergraduate Min: 4      Graduate Min: 4 Undergraduate Max: 4      Graduate Max: 4	Half Term Credit Hours Undergraduate Min:      Graduate Min: Undergraduate Max:      Graduate Max:												
<input checked="" type="checkbox"/>	Course Credit Type Undergraduate Student, Rackham Graduate Student, Non-Rackham Graduate Student													
<input type="checkbox"/>	Repeatability <input type="checkbox"/> Course is Repeatable for Credit Maximum number of repeatable credits:	<input type="checkbox"/> Course is Y graded <input type="checkbox"/> Can be taken more than once in the same term												


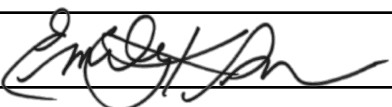


	Subject:	Catalog:			
<input checked="" type="checkbox"/>	<b>Grading Basis</b> <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration <b>Grading</b> <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only				
	<b>Add Consent</b> <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent		<b>Drop Consent</b> <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent		

	CURRENT LISTING	REQUESTED LISTING
<input checked="" type="checkbox"/>	Advisory Prerequisite (254 char)	Advisory Prerequisite (254 char) Coursework in artificial intelligence or robotics
<input checked="" type="checkbox"/>	Enforced Prerequisite (254 char) Minimum grade requirement:	Enforced Prerequisite (254 char) Graduate standing or permission of the instructor Minimum grade requirement:
<input type="checkbox"/>	Credit Exclusions	Credit Exclusions
<input checked="" type="checkbox"/>	<b>Course Components</b> <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Discussion <input type="checkbox"/> Independent Study	<b>Graded Component</b> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
	<b>Terms Typically Offered</b> <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer	
Cognizant Faculty Member Name: Benjamin Kuipers		
Cognizant Faculty Member Title:		

**SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED (Please Print AND Sign Name)**

Contact Person: Punam Vyas      Email: vyas@umich.edu      Phone: 647-1754

CoE Curriculum Committee Representative: 	Print: Amir Kamil	Date: 3/24/23
CoE Curriculum Committee Chair:	Print:	Date:
Home Department Chair: 	Print: Emily Provost	Date: 3/24/23
Cross-Listed Department Chair:	Print:	Date:
Cross-Listed Department Chair:	Print:	Date:
Cross-Listed Department Chair:	Print:	Date:

DEPARTMENTAL/COLLEGE USE ONLY
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**Current:****Requested:**Course DescriptionCourse Description

Ethical issues raised by AI and Robotics. Foundations in philosophical ethics and game theory; trust, cooperation, and the well-being of society; safety and autonomous vehicles; privacy and surveillance; fairness and bias; jobs and economic inequality; regulation of AI. Class discussions, literature review, and final term paper.

Class LengthClass Length

Full term

Contact hours (lecture):Contact hours (lecture):

3

Contact hours (recitation)Contact hours (recitation)

1

Contact hours (lab)Contact hours (lab)**Additional Info:**Submitted by:

Home dept

Describe how this course fits with the degree requirements:

Satisfies the 500-level and technical elective requirements for CSE MS degree, and the depth requirement for CSE PhD degree.

Special resources of facilities required for this course:Supporting statement:

Demand for course offerings on the ethics of AI and robotics has been increasing, both from students and from the general public. Versions of this course have been taught for the last four Winter terms, with substantial enrollments.

Past offerings:

- Winter 2020: 56 students (16 in EECS 498, 26 in EECS 598, 14 in ROB 599)
- Winter 2021: 32 students (10 in EECS 498, 15 in EECS 598, 7 in ROB 599)
- Winter 2022: 34 students (9 in EECS 498, 16 in EECS 598, 9 in ROB 599)
- Winter 2023: 54 students (10 in EECS 498, 44 in EECS 598, 1 in ROB 599)

# Ethics for AI and Robotics (EECS 598/498, ROB 599)

- Winter 2023. 4 credits.
- When/Where:
  - Lectures: MW 4:30 - 6:00 pm, **in person** in Beyster 1670.
  - Discussion: F 3:30 - 4:30 pm, **in person** in FMCRB 1060.
- Professor [Benjamin Kuipers](mailto:kuipers@umich.edu) (kuipers@umich.edu)
  - Office hours: MW 3:00 - 4:00 pm in Beyster 3765 (and by appointment, in person or via Zoom).
- GSI: Shivangi Puthiyedath (tpshiv@umich.edu)
  - Office hours: Th 2:00 - 4:00 pm and F 11:30 am to 1:30 pm, at Table One in the Beyster Learning Center (first floor hallway toward Dow).
- [Schedule of classes](#)
- [Reading assignments](#) (**Remember to check for updates!**)
- Prerequisites (Advisory):
  - (For graduate students) Some technical background in AI and/or Robotics such as EECS 492 (Intro to Artificial Intelligence) or ROB 550 (Robotics Systems Laboratory), **or** permission of the instructor.
  - (For undergraduates) Some technical background in AI and/or Robotics such as EECS 367 or EECS 467 or EECS 492 or EECS 442 or EECS 445, **plus** permission of instructor.
- Requirements: extensive reading; active participation in discussions; two research papers. Attendance will be taken. No final exam.
- **This page will be updated from time to time.**
  - Most recent update: 3-28-2023.

## Course Description

Artificial Intelligence, Machine Learning, and Robotics have seen dramatic progress in the last several decades. There is increasing excitement and apprehension about the impact of these technologies, deployed in our world and our human society.

- Autonomous vehicles could save many lives, but lives have already been lost due to technological failures.
- Intelligent automation could make some kinds of jobs into scarce resources.
- Search engines and social networks provide desirable, even addictive, “free” services, in return for personal information.
- Data mining our online interactions amounts to digital surveillance.
- Autonomous systems could unintentionally do substantial harm.
- Some people think that super-intelligent AI will threaten the survival of humanity.

Ethics is the discipline within philosophy that considers which actions we humans see as right or wrong, or as good or bad. As we design intelligent artifacts that make their own decisions about how to act, and as they act within the human world, we ask how we can ensure that they will act ethically.

Two important questions arise.

First, like any other powerful technology (e.g. nuclear power, genetic engineering), there are important ethical questions about how AI and robotics technology can and should be deployed, and what its impact will be on society. This topic includes regulations, and the processes by which regulations are proposed, adopted, and enforced.

Second, unlike other technologies, AI (and thus intelligent robotics) involves creating agents that make their own decisions about how to act in the world. Ethics is a kind of foundational knowledge that humans use to decide how to act. We need to understand the structure of that knowledge, so the AIs we create will have the knowledge they need to act appropriately.

Do we mean that humans must be ethical as we design and deploy intelligent systems? Do we mean that the systems we design and deploy must be capable of deciding what is ethical for them to do? Most likely, the answers to both questions will turn out to be “Yes!” The follow-on question is “How do we do that?”

The semester will be organized around several major topic areas:

- Foundations: Philosophical ethics, game theory, trust, cooperation, and society
- Safety: Autonomous vehicles and their driving decisions
- Surveillance and privacy
- Bias and fairness
- Economic inequality, and trust for corporate entities: corporations, governments
- Existential risk

In the course of discussing research on these problem areas, we will draw on concepts from philosophical ethics, and from engineering design, law, economics, evolution, history, human development, etc.

An important question for researchers in artificial intelligence and robotics is how the knowledge relevant to making ethical decisions can be represented computationally in a knowledge base, and how it can be acquired.

## **Class meetings**

**Lectures:** two each week, 80 minutes each (MW 4:30 - 5:50 pm).

**Discussion:** one each week, 50 minutes (F 3:30 - 4:20 pm).

(Attendance will be taken, and counted toward the Participation grade.)

We plan to have a number of guest lecturers.

The lectures will include opportunities for class discussion. The Discussion meeting will go into further depth on issues that come up in lectures, but may also explore important issues in current news. Some discussions will involve the entire class, but we may also break into small groups.

## **What if you must miss attending class?**

- Send email (kuipers@umich.edu, tpshiv@umich.edu) describing the reason.
- Keep up with the reading assignments (link near the top of this page).
- Read the slides (Canvas > Files/slides).
- Watch the lecture recording (Canvas > Lecture recordings).
- Participate in discussions on Piazza (Canvas > Piazza).

Attendance does count toward the Participation grade (and so does interaction on Piazza). I recognize that a modest number of absences are inevitable and will not be penalized. Large numbers of absences are a problem, though.

## **Covid**

- We hope that the Covid situation will allow us to have normal in-person classes. Of course, we will follow all University health requirements. Please contact me if you need special accommodation.
- Current University of Michigan policy requires all classes to be held in person, and all students, faculty, and staff to be fully vaccinated. Furthermore, the ventilation of all classrooms has been upgraded.

## Course requirements

Each student will attend the classes, do the readings, participate in the discussions, and write two papers. Attendance and participation will have significant weight (20%) in the course grade.

There will be extensive [reading assignments](#), typically two required papers for each class. (Additional recommended readings will often be provided.) For each required paper, before the corresponding class, enter a thoughtful comment on the Piazza thread provided for that paper. These comments will be counted toward the participation grade.

Pick a **topic** for your two term papers by the end of January (1-30-2023). Don't restrict yourself to what we've already covered in the course. Look ahead in the schedule and the reading assignments, or come up with something else. Submit for comments and advice, but not counted toward the course grade.

In the **first paper**, due at mid-term (3-6-2023), you will review the available literature related to the topic you have selected. The goal of your paper is to identify, clarify, and summarize the major positions on your topic. Counts for 40% of the course grade.

In the **second paper**, due at the end of the term (4-17-2023), you will pick a question, take a position on how it should be answered, and justify your position, responding clearly to anticipated arguments from critics of that position. Counts for 40% of the course grade. Focusing either or both papers on the topic submitted in January is not required, but it will obviously make both papers stronger.

Course grades will be curved if needed, though in recent years no curve has been necessary.

You will need to find and read additional papers and possibly books as part of your literature review and final term paper. Be sure that you know how to use [Google Scholar](#) and the [UM Library's Online Journal](#) collection for tracking down references.

The following paper is a good example of a literature review, and it is also highly relevant to the content of the course. Read it before the start of the course.

- Peter Kollock, Social Dilemmas: The Anatomy of Cooperation. *Annual Review of Sociology* 24: 183-214, 1998.
- Read the abstract [here](#).
- The University of Michigan Library [Online Journal collection](#) has subscriptions to a vast collection of academic journals and other publications. This will allow you to download a copy of this paper for free, instead of paying the fee at the previous link. (The ability to do this will be essential for your literature review.)

When you write your own literature review, it need not match this in length or style, but this paper is an aspirational target. For your paper, imagine that you are providing

detailed help on a particular focused topic, to a friend who wants to get started doing research on that specific topic.

## Course format

This course is offered to multiple audiences through several course numbers.

- **EECS 598-001** (four-credit graduate special topics course)
- **EECS 498-001** (four-credit undergraduate special topics course)
- **ROB 599-004** (four-credit graduate special topics course)
  - We plan to have regular course numbers by W24.

This course describes and discusses the ethical issues raised by AI and Robotics, reading and analyzing arguments from a number of disciplines, identifying and posing ethical questions, evaluating potential solutions, and formulating future research questions. The course will include guest lectures from experts in computer science, philosophy, cognitive science, psychology, public policy, law, etc.

For the undergraduate course (EECS 498-001), the two papers should demonstrate that you can search, find, and review good quality references beyond those handed out in class, and that you can put your own creative and critical insights into formulating a good problem and exploring solutions to it.

The expectation for the graduate course (EECS 598-001, ROB 599-004) will be (a) a deeper and more analytical literature review that identifies more related work beyond what has been handed out in class, and (b) a deeper and more thoughtful final term paper, anticipating and responding more effectively to critics.

EECS 598 has been approved to satisfy the following [CSE Graduate Program requirements](#): depth (not cognate) requirement for the CSE PhD, and the 500-level and technical elective requirements for the CSE MS (confirmed: 11/19/2021).

EECS 498 has been approved to satisfy the [College of Engineering Intellectual Breadth requirement](#) for the CS-Eng, DS-Eng, CE, and EE majors (confirmed: 11/19/2021). (Since this is a special topics course, it doesn't yet show up on the degree audit, but it is manually added after the Drop/Add deadline.)

## Piazza for Questions and Online Discussion

We use Piazza as our platform for online discussion outside of class.

This term (W23) we are experimenting with students being required to post a short comment on a Piazza thread for each of two assigned readings in preparation for each lecture. This seems to be very successful. These posts count toward the Participation grade.

## On Collaboration

Students learn more when they collaborate actively with each other. But you also learn more when you take responsibility for doing your own work. Be prepared to teach each other, and to learn from each other, but not to do each others' work.

Discuss all the topics in the course, but especially the topics of your papers, with each other. Recommend papers to each other. Read and comment on each others' drafts as

[alpha and beta readers](#). But formulate and defend your own opinions, and write your own papers.

It is not a course requirement that you publish your paper in a conference or journal, but that's certainly a great outcome! After the course is over, it is entirely reasonable to combine and revise closely related papers into a joint submission for publication.

## Suggested readings . . .

- [The Blind Men and the Elephant](#).

Anyone working in this area should understand the lesson of this children's poem.

- [Nonzero, by Robert Wright](#)

*Nonzero* describes human biological and cultural evolution in a framework provided by game theory.

- [Burn-In, by P. W. Singer and August Cole](#)

*Burn-In* is a novel, written to demonstrate possible social impacts of AI and robotics technology over the next decade or two. Many end-notes giving citations for the reality of the technology. It vividly illustrates the potential for serious problems, and the technological extrapolations are well researched, but remember that this is only one of many possible futures.

- [The Ministry for the Future, by Kim Stanley Robinson](#)

*The Ministry for the Future* is another novel of a possible future, showing how humanity might respond to the threat of climate change over the next several decades. AI and robotics have only a small role, but the need and the difficulty of establishing trust and cooperation are central.

- [Evil Geniuses: The Unmaking of America, A Recent History, by Ken Andersen](#)

*Evil Geniuses* discusses the political economics of the last half-century, leading up to the current level of economic inequality. The author has a strong and clearly stated political position. Even if you disagree, you should understand and respond to his arguments.

- <http://web.eecs.umich.edu/~kuipers/research/pubs/Kuipers-oheai-20.html>  
<http://web.eecs.umich.edu/~kuipers/research/pubs/Kuipers-frai-22.html>

My chapter in the *Oxford Handbook of Ethics of AI* (2020) and my article in *Frontiers in Robotics and AI* (2022) provide overviews of some of the topics we will cover in the course.

- To appreciate the urgency of this area of study, watch these two videos:
  - [Slaughterbots](#) (video: 7:47)
  - [if human: kill\(\)](#) (video: 5:27)

Then read about the problem of [lethal autonomous weapons](#).

- [Resources: Ethics for AI and Robotics](#)

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*BJK*



	<b>Date</b>		<b>Topic</b>	<b>Due</b>
1	1/4/23	0	Course introduction	
2	1/9/23	1.1	Philosophical ethics	
3	1/11/23	1.2	The Prisoner's Dilemma	
	1/16/23		<b>MLK day</b>	
4	1/18/23	1.3	Ethics, Trust, and Cooperation	
5	1/23/23	1.4	Evolutionary origins	
6	1/25/23	2.1	Why should we build autonomous vehicles?	
7	1/30/23	2.2	Moral dilemmas for autonomous vehicles	topic
8	2/1/23	2.3	Guest lecture: Phil Koopman & Bill Widen	
9	2/6/23	2.4	What are the actual ethical issues for AVs?	
10	2/8/23	3.1	Surveillance: Florian Schaub guest lecture	
11	2/13/23	3.2	Surveillance: Balancing the Good and the Bad	
12	2/15/23	3.3	How comprehensive is individual surveillance?	
13	2/20/23	3.4	Surveillance capitalism	
14	2/22/23	3.5	Regulating surveillance	
			<b>Winter Break</b>	
15	3/6/23	4.1	Algorithmic bias	lit review
16	3/8/23	4.2	Formalizing fairness	
17	3/13/23	4.3	Jagadish guest lecture: regulation of bias	
18	3/15/23	4.4	Bias, Fairness, Equity	
19	3/20/23	4.5	Can we achieve trustworthy fairness?	
20	3/22/23	5.1	The future of work	
21	3/27/23	5.2	Economic inequality	
22	3/29/23	5.3	Corporations as intelligent agents	
23	4/3/23	5.4	Is superintelligence an existential threat?	
24	4/5/23	6.1	Guest lecture: Dan Crane on AI regulation	
25	4/10/23	6.2	Can we / Should we regulate AI?	
26	4/12/23	6.3	Flex and surge	
27	4/17/23	6.4	Flex and surge	term paper

# Reading Assignments for Ethics for AI and Robotics (EECS 598/498 and ROB 599)

**Benjamin Kuipers**  
**Winter 2023**

Draft: February 27, 2023

Recent progress in AI and Robotics has made the problem of Ethics increasingly urgent. Many people have started to approach many different aspects of this problem, but there is little consensus (yet) about the right questions, or their answers. Everyone participating in this class will help to formulate these questions and answers.

Some readings will be at URLs supplied. Some, with citations like [LeGuin-omelas-73] can be found in Canvas > Files/readings or Canvas > Files/news. Others, with citations like [Singer, 1981], are journal articles or books you can find in the library, and the full reference is at the end.

## 0 Course Introduction (1/4/23)

- **Reading Assignment** (read before class)

Course syllabus: <https://web.eecs.umich.edu/~kuipers/teaching/eecs598-W23.html>

“The Blind Men and the Elephant”: <https://web.eecs.umich.edu/~kuipers/opinions/Elephant.html>

ACM Code of Ethics and Professional Conduct: <https://www.acm.org/code-of-ethics>

IEEE Code of Ethics: <https://www.ieee.org/about/corporate/governance/p7-8.html>

- **Other Readings** (valuable for many purposes)

7000-2021 - IEEE Standard Model Process for Addressing Ethical Concerns during System Design:

<https://ieeexplore.ieee.org/document/9536679>

Consider other suggested readings on the syllabus web page.

## 1 Foundations

### 1.1 Philosophical Ethics (1/9/23)

- **Reading Assignment** (read before class)

In the Stanford Encyclopedia of Philosophy (SEP), read enough from each of these articles to get the general idea, and to be able to go back for more depth as needed. The SEP is a valuable reference.

Utilitarianism (<https://plato.stanford.edu/entries/utilitarianism-history/>)

Consequentialism (<https://plato.stanford.edu/entries/consequentialism/>)

Deontology (<https://plato.stanford.edu/entries/ethics-deontological/>)

Virtue Ethics (<https://plato.stanford.edu/entries/ethics-virtue/>)

Contractarianism (<https://plato.stanford.edu/entries/contractarianism/>)

Contractualism (<https://plato.stanford.edu/entries/contractualism/>)

- **Other Readings** (valuable for many purposes)

“Those who walk away from Omelas” by Ursula LeGuin [LeGuin-omelas-73].

Peter Singer, *The Expanding Circle* [Singer, 1981]

John Rawls, *A Theory of Justice* [Rawls, 1999]

## 1.2 The Prisoner's Dilemma (1/11/23)

- **Reading Assignment** (read before class)
  - Leyton-Brown & Shoham, *Essentials of Game Theory*, ch.1-2 [Leyton-Brown+Shoham-08-ch.1-2]
  - Anatol Rapaport, The use and misuse of game theory [Rapaport-sciam-62]
- **Other Readings** (valuable for many purposes)
  - Axelrod & Hamilton, The evolution of cooperation [Axelrod-science-81]
  - Robert Axelrod, *The Evolution of Cooperation* [Axelrod, 1984]
  - . . . and more useful references in the slides.

## 1.3 Ethics, Trust, and Cooperation (1/18/23)

- **Reading Assignment** (read before class)
  - Kuipers, Trust and Cooperation <https://web.eecs.umich.edu/~kuipers/research/pubs/Kuipers-frai-22.html>
  - Mayer, Davis & Schoorman, An integrative model of organizational trust. [Mayer et al., 1995]
- **Other Readings** (valuable for many purposes)
  - Ethics Guidelines for Trustworthy AI* [on AI, 2019]
  - Rousseau, et al, Not so different after all . . . [Rousseau et al., 1998]
  - Lee & See, Trust in automation [Lee and See, 2004]
  - Jeannette Wing, Trustworthy AI [Wing, 2021]
  - Sreedhar & Gopal, Behind low vaccination rates . . . [Sreedhar-nyt-12-3-21]

## 1.4 Evolutionary Origins (1/23/23)

- **Reading Assignment** (read before class)
  - Tomasello, et al, Two key steps in the evolution of human cooperation. *Current Anthropology*, 2012. [Tomasello et al., 2012]
  - Boyd, Richerson & Henrich, The cultural niche: Why social learning is essential for human adaptation. *Proc. Nat. Acad. Sci. (PNAS)*. 2011. [Boyd et al., 2011]
- **Other Readings** (valuable for many purposes)
  - Henrich, *The Secret of Our Success*, 2016. [Henrich, 2016]
  - Henrich, et al, Markets, religion, community size, and the evolution of fairness and punishment. *Science*, 2010. [Henrich et al., 2010]
  - Rand, et al, Social heuristics shape intuitive cooperation. *Nature Communication*, 2014. [Rand et al., 2014]
  - Henrich & Muthukrishna, The origins and psychology of human cooperation. *Annual Review of Psychology*, 2021. [Henrich and Muthukrishna, 2021]

## 2 Safety and Autonomous Vehicles

### 2.1 Why should we build autonomous vehicles?

- **Reading Assignment** (read before class)  
NHTSA, Critical reasons for crashes . . . , 2018.  
<https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812506>  
SAE autonomy levels [SAE J3016 levels 5-21]  
Waymo Safety Report, September 2021. <https://waymo.com/safety>
- **Other Readings** (valuable for many purposes)  
NHTSA Voluntary Safety Self-Assessments, <https://www.nhtsa.gov/automated-driving-systems/voluntary-safety-self-assessment>  
Rodney Brooks, Blog. <https://rodneybrooks.com/blog/>

### 2.2 Moral dilemmas for autonomous vehicles

- **Reading Assignment** (read before class)  
Awad et al, The Moral Machine experiment. [Awad-nature-18]  
Kuipers, Perspectives on Ethics of AI: Computer Science.  
(<https://web.eecs.umich.edu/~kuipers/research/pubs/Kuipers-oheai-20.html>)
- **Other Readings** (valuable for many purposes)  
Judith Jarvis Thomson, The Trolley Problem. [Thomson-ylj-85]  
Philippa Foot, The problem of abortion and the doctrine of double effect. [Foot-or-67]  
Bonneton et al, The social dilemma of autonomous vehicles. [Bonneton-science-16]  
Awad et al, Crowdsourcing moral machines. [Awad-cacm-20]

### 2.3 AVs and regulations: Widen & Koopman guest lecture

- **Reading Assignment** (read before class)  
Koopman, SAE J3016 Users Guide, 2021. <https://users.ece.cmu.edu/~koopman/j3016/>  
Widen & Koopman, Autonomous vehicle regulation & trust, *UCLA J. Law & Technology*, 2022.  
[Widen and Koopman, 2022]  
Koopman & Widen, Ethical design & testing of automated driving features [Koopman-ssrn-1-24-23]
- **Other Readings** (valuable for many purposes)  
[https://en.wikipedia.org/wiki/Self-driving\\_car](https://en.wikipedia.org/wiki/Self-driving_car)

### 2.4 What are the actual ethical issues for AVs?

- **Reading Assignment** (read before class)  
Cade Metz, NYTimes: [Metz-nyt-12-7-21] [Metz-nyt-6-8-22] [Metz-nyt-2-1-23]  
Rodney Brooks, roboticist: (just read the predictions about self-driving cars)  
<https://rodneybrooks.com/edge-cases-for-self-driving-cars/>  
<https://rodneybrooks.com/my-dated-predictions/> (2018)  
<https://rodneybrooks.com/predictions-scorecard-2023-january-01/>

- **Other Readings** (valuable for many purposes)
  - <http://rodneybrooks.com/predictions-scorecard-2019-january-01/>
  - <http://rodneybrooks.com/predictions-scorecard-2020-january-01/>
  - <http://rodneybrooks.com/predictions-scorecard-2021-january-01/>
  - <https://rodneybrooks.com/predictions-scorecard-2022-january-01/>

### 3 Surveillance and Privacy

#### 3.1 Guest lecture: Florian Schaub, UM SI

- **Reading Assignment** (read before class)
  - Schaub, Balebako & Cranor, Designing effective privacy notices and controls. [Schaub et al., 2017]. Longer version: [Schaub-iptp-20].
  - Acquisti, Brandimarti & Loewenstein, Secrets and Likes: The drive for privacy and the difficulty of achieving it in the digital age, 2020 [Acquisti et al., 2020].<sup>1</sup>
- **Other Readings** (valuable for many purposes)
  - Harkous, et al, Polisis:Automated analysis and presentation of privacy policies using deeplearning. [Harkous et al., 2018]
  - Kumar, et al, Finding a choice in a haystack: Automating extraction of opt-out statementsfrom privacy policy text. [Kumar-www-20]

#### 3.2 Surveillance: Balancing the Good and the Bad

- **Reading Assignment** (read before class)
  - VanBavel, et al, How social media shapes polarization. [VanBavel-tics-21]
  - Rathje, et al, Out-group animosity drives engagement on social media. [Rathje-pnas-21]
- **Other Readings** (valuable for many purposes)
  - Karen Hao, How Facebook got addicted to spreading misinformation. [Hao-tr-21]
  - Ben Smith, Inside the information wars. [Smith-nyt-11-28-21]
  - <https://www.nytimes.com/series/new-york-times-privacy-project>

#### 3.3 How comprehensive is individual surveillance?

- **Reading Assignment** (read before class)
  - NYT Editorial, Total surveillance is not what America signed up for. [NYT-Editorial-12-21-19]
  - <https://www.nytimes.com/interactive/2019/12/19/opinion/location-tracking-cell-phone.html>
  - Steinberger, Does Palantir see too much? [Steinberger-nyt-10-21-20]
  - Stark, Facial recognition is the plutonium of AI. [Stark-xrds-19]
  - Kashmir Hill, The secretive company that might end privacy as we know it. [Hill-nyt-1-18-20]
  - Blatt, Some observations on the Clearview AI facial recognition system – from someone who has actually used it. [Blatt-cpomag-20]
  - Kashmir Hill, Your face is not your own. [Hill-nyt-3-21-21]

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<sup>1</sup>I can't provide you with a PDF copy of this paper, but you can read the paper online through the University Library's online journal collection.

- **Other Readings** (valuable for many purposes)
  - Valentino, Your apps know where you were last night, and they're not keeping it secret. [Valentino-nyt-12-10-18]
  - Warzel & Thompson, They stormed the Capitol. Their apps tracked them. [Warzel-nyt-2-5-21]
  - Arthur Michel, There are spying eyes everywhere – and now they share a brain [Palantir]. [Michel-wired-2-4-21]

### 3.4 Surveillance capitalism

- **Reading Assignment** (read before class)
  - Shoshana Zuboff, How Google discovered the value of surveillance. [Zuboff-longreads-19]
  - Zuboff, Big other: surveillance capitalism and the prospect for an information civilization. [Zuboff, 2015]
- **Other Readings** (valuable for many purposes)
  - <https://safecomputing.umich.edu/privacy/history-of-privacy-timeline>
  - Shoshana Zuboff, *The Age of Surveillance Capitalism*, 2019. [Zuboff, 2019]
  - Zuboff, You are now remotely controlled. [Zuboff-nyt-1-24-20]
  - Zuboff, The coup we are not talking about. [Zuboff-nyt-1-29-21]
  - Zuboff, You are the object of a secret extraction operation. [Zuboff-nyt-11-12-21]
  - Bruce Schneier, Banning facial recognition isn't enough. [Schneier-nyt-1-20-20]

### 3.5 Regulating surveillance

- **Reading Assignment** (read before class)
  - Helen Nissenbaum, A contextual approach to privacy online. [Nissenbaum, 2011].
  - <https://www.nytimes.com/series/new-york-times-privacy-project>
- **Other Readings** (valuable for many purposes)
  - Nissenbaum, *Privacy in Context: Technology, Policy, and the Integrity of Social Life*, 2010.
  - Gajda, *Seek and Hide: The Tangled History of the Right to Privacy* [Gajda, 2022].
  - Isaac & Hsu, Meta plans to remove thousands of sensitive ad-targeting categories. [Isaac-nyt-11-9-21]
  - ONeill, How facial recognition makes you safer. [ONeill-nyt-6-9-19]
  - Friedman, China's bullying is becoming a danger to the world and itself. [Friedman-nyt-10-19-21]
  - Mueller & Castro, The value of personalized advertising in Europe. [Mueller-cdi-21]
  - Frank, The economic case for regulating social media. [Frank-nyt-2-11-21]

## 4 Bias and Fairness

### 4.1 Algorithmic bias

- **Reading Assignment** (read before class)
  - Buolamwini & Gebru, Gender Shades: Intersectional accuracy disparities in commercial gender classification. [Buolamwini-fat\*-18]
  - Obermeyer, et al, Dissecting racial bias in an algorithm used to manage the health of populations. [Obermeyer-science-19]

- **Other Readings** (valuable for many purposes)
  - Charette, Michigan's MiDAS unemployment system: Algorithm alchemy created lead, not gold. [Charette-spectrum-18]
  - Raji, et al, Actionable auditing: Investigating the impact of publicly naming biased performance results of commercial AI products. [Raji-aies-19]
  - Raji, et al, Saving face: Investigating the ethical concerns of facial recognition auditing. [Raji-aies-20]
  - Barocas, Hardt & Narayanan, chap.1. <https://fairmlbook.org/pdf/introduction.pdf>

## 4.2 Formalizing Fairness

- **Reading Assignment** (read before class)
  - Chouldechova, Fair prediction with disparate impact: a study of bias in recidivism prediction instruments. [Chouldechova, 2017]
  - Kleinberg, et al, Inherent trade-offs in the fair determination of risk scores. ITCS, 2017. [Kleinberg et al., 2017]
- **Other Readings** (valuable for many purposes)
  - Barocas, Hardt & Narayanan, chap.2. <https://fairmlbook.org/pdf/classification.pdf>

## 4.3 Guest lecture: H. V. Jagadish, UM CSE

- **Reading Assignment** (read before class)
- **Other Readings** (valuable for many purposes)

## 4.4 Bias, Fairness, Equity

- **Reading Assignment** (read before class)
- **Other Readings** (valuable for many purposes)
  - Kurt Vonnegut, Harrison Bergeron. [Harrison Bergeron.rtf]
  - The Orange Story. <http://www.mediationtools.com/articles/smbj9605.html>

## 4.5 Can we achieve trustworthy fairness?

- **Reading Assignment** (read before class)
  - Lee, et al, Algorithmic bias detection and mitigation: Best practices and policies to reduce consumer harms. Brookings report, 2019. [Lee-brookings-19]
- **Other Readings** (valuable for many purposes)
  - Gordon R. Dickson, Computers Dont Argue. *Analog Science Fiction*, September 1965. <https://www.atariarchives.org/bcc2/showpage.php?page=133>

## 5 Jobs, Automation, and Existential Threats

### 5.1 The future of work

- **Reading Assignment** (read before class)
  - What can machine learning do? [Brynjolfsson and Mitchell, 2017]
  - Evaluating revolutions in AI [Forbus, 2021]
- **Other Readings** (valuable for many purposes)
  - Brynjolfsson & McAfee, *The Second Machine Age* [Brynjolfsson and McAfee, 2014].
  - Martin Ford, *The Rise of the Robots* [Ford, 2015].
  - The Work of the Future [Autor-mittfwork-20]
  - One day of employment a week is all we need for mental health benefits. <https://www.sciencedaily.com/releases/2019/06/190618192030.htm>
  - Soon a robot will be writing this headline (NYT Book Review) <https://www.nytimes.com/2020/01/14/books/review/a-world-without-work-daniel-susskind.html>
  - Can child care be a big business? Private equity thinks so. [Goldstein-nyt-12-16-22]
  - Why you can't find child care. 100,000 workers are missing. [Goldstein-nyt-10-13-22]
  - How other nations pay for child care. The U.S. is an outlier. [Miller-nyt-10-6-21]
  - Policymakers used to ignore child care. Then came the pandemic. [Peck-nyt-5-9-21]
  - "Would you let a robot take care of your Mom?" [Jackson-nyt-12-13-19]
  - "The future of robot caregivers" [Aronson-nyt-7-19-14]

### 5.2 Economic inequality

- **Reading Assignment** (read before class)
  - Kuipers, Perspectives on Ethics of AI: Computer Science. (Example 3; follow footnotes) <https://web.eecs.umich.edu/kuipers/research/pubs/Kuipers-oheai-20.html>.
  - McWilliams, "This political theorist predicted the rise of Trumpism. His name was Hunter S. Thompson." *The Nation*, 2016. [McWilliams, 2016]
- **Other Readings** (valuable for many purposes)
  - [Leonhardt, 2019]
  - [Appelbaum, 2019]
  - [Edsall, 2021]
  - [Sorkin, 2019]

### 5.3 Corporations as intelligent agents

- **Reading Assignment** (read before class)
  - Kuipers, An existing, ecologically-successful genus of collectively intelligent artificial creatures, Collective Intelligence, 2012. <https://web.eecs.umich.edu/kuipers/research/pubs/Kuipers-ci-12.html>
  - Milton Friedman, The social responsibility of business is to increase its profits. [Friedman-nytmag-70]
- **Other Readings** (valuable for many purposes)
  - Richard Danzig, Machines, Bureaucracies and Markets as AIs. [Danzig-cset-22].



Business Roundtable on Corporate Governance (8-19-2019)

<https://www.businessroundtable.org/business-roundtable-redefines-the-purpose-of-a-corporation-to-promote-an-economy-that-serves-all-americans>

<https://opportunity.businessroundtable.org/ourcommitment/>

#### 5.4 Is superintelligent AI an existential threat?

- **Reading Assignment** (read before class)
  - Vernor Vinge, The Technological Singularity, 1993/2003. [Vinge-wer-03]
  - Hadfield-Menell, Dragan, Abbeel, Russell, Cooperative inverse reinforcement learning. NIPS, 2016. [Hadfield-Menell-nips-16]
- **Other Readings** (valuable for many purposes)
  - Dylan Hadfield-Menell, The principal-agent alignment problem in artificial intelligence. PhD thesis, EECS, UC Berkeley, 2021. [Hadfield-Menell-phd-21]
  - Stray, Vandro, Nixon, Adler, Hadfield-Menell, What are you optimizing for? Aligning recommender systems with human values. ArXiv:2107.10939, 22 July 2021. [Stray-arxiv-21]
  - Leqi, Hadfield-Menell, Lipton, When curation becomes creation. CACM 64(12): 44-47, December 2021. [Leqi-cacm-21]
  - Tim Urban, The AI revolution: the road to superintelligence, 2015. <https://waitbutwhy.com/2015/01/artificial-intelligence-revolution-1.html>
  - Tim Urban, The AI revolution: our immortality or extinction, 2015. <https://waitbutwhy.com/2015/01/artificial-intelligence-revolution-2.html>

## 6 Regulation of AI

### 6.1 Can we / Should we regulate AI?

- **Reading Assignment** (read before class)
  - Brundage, et al, Toward trustworthy AI development: Mechanisms for supporting verifiable claims. Executive summary, Sections 1 & 5, the rest as needed. <http://www.towardtrustworthyai.com>
  - Jobin, et al, The global landscape of AI ethics guidelines. [Jobin-nmi-19]
- **Other Readings** (valuable for many purposes)

### 6.2 Can we / Should we regulate AI?

- **Reading Assignment** (read before class)
- **Other Readings** (valuable for many purposes)

### 6.3 Flex and surge

- **Reading Assignment** (read before class)
- **Other Readings** (valuable for many purposes)

**6.4 Flex and surge**

- **Reading Assignment** (read before class)
- **Other Readings** (valuable for many purposes)

## References

- [Acquisti et al., 2020] Acquisti, A., Brandimarti, L., and Loewenstein, G. (2020). Secrets and likes: The drive for privacy and the difficulty of achieving it in the digital age. *Journal of Consumer Psychology*, 30(4):736–758. <https://doi.org/10.1002/jcpy.1191>.
- [Appelbaum, 2019] Appelbaum, B. (2019). Blame economists for the mess we’re in. *The New York Times*. <https://www.nytimes.com/2019/08/24/opinion/sunday/economics-milton-friedman.html>.
- [Axelrod, 1984] Axelrod, R. (1984). *The Evolution of Cooperation*. Basic Books.
- [Boyd et al., 2011] Boyd, R., Richerson, P. J., and Henrich, J. (2011). The cultural niche: Why social learning is essential for human adaptation. *Proc. Nat. Acad. Sciences (PNAS)*, 108:10918–10925.
- [Brynjolfsson and McAfee, 2014] Brynjolfsson, E. and McAfee, A. (2014). *The Second Machine Age*. W. W. Norton & Co.
- [Brynjolfsson and Mitchell, 2017] Brynjolfsson, E. and Mitchell, T. (2017). What can machine learning do? workforce implications. *Science*, 358:1530–1534. doi:10.1126/science.aap8062.
- [Chouldechova, 2017] Chouldechova, A. (2017). Fair prediction with disparate impact: A study of bias in recidivism prediction instruments. Technical Report arXiv:1703.00056, arXiv. <https://arxiv.org/pdf/1703.00056.pdf>.
- [Edsall, 2021] Edsall, T. B. (2021). Why Trump still has millions of Americans in his grip. *New York Times*. <https://www.nytimes.com/2021/05/05/opinion/trump-automation-artificial-intelligence.html>.
- [Forbus, 2021] Forbus, K. D. (2021). Evaluating revolutions in artificial intelligence from a human perspective. In OECD, editor, *AI and the Future of Skills*, volume Volume 1: Capabilities and Assessments, pages 34–48. OECD Publishing, Paris. <https://doi.org/10.1787/004710fe-en>.
- [Ford, 2015] Ford, M. (2015). *Rise of the Robots: Technology and the Threat of a Jobless Future*. Basic Books.
- [Gajda, 2022] Gajda, A. (2022). *Seek and Hide: The Tangled History of the Right to Privacy*. Viking.
- [Harkous et al., 2018] Harkous, H., Fawaz, K., Le Bret, R., Schaub, F., and Shin, K. G. (2018). Polisis: Automated analysis and presentation of privacy policies using deep learning. In *Proc. 27th USENIX Security Symposium*, pages 531–548.
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# University of Michigan

## Winter 2020 Instructor Report With Comments

### EECS 498 001 - EECS 598 001 - ROB 599 004

### Benjamin Kuipers

18 out of 55 students responded to this evaluation.

#### Responses to University-wide questions about the course:

	SA	A	N	D	SD	N/A	Your Median	Univ-wide Median	School/College Median
This course advanced my understanding of the subject matter. (Q1631)	9	7	1	0	1	0	4.5	4.5	4.4
My interest in the subject has increased because of this course. (Q1632)	9	7	1	0	1	0	4.5	4.2	4.1
I knew what was expected of me in this course.(Q1633)	9	7	0	1	1	0	4.5	4.5	4.3
Overall, this was an excellent course.(Q1)	10	5	1	1	1	0	4.6	4.3	4.2
I had a strong desire to take this course.(Q4)	13	4	0	0	1	0	4.8	4.1	4.0
As compared with other courses of equal credit, the workload for this course was (SA=Much Lighter, A=Lighter, N=Typical, D=Heavier, SD=Much Heavier). (Q891)	3	9	5	0	0	1	3.9	3.0	2.9
How did the unexpected change to remote course format affect your learning experience in this course this term? (SA=Very Positively Affected, A=Somewhat Positively Affected, N=No Effect, D=Somewhat Negatively Affected, SD=Very Negatively Affected) (Q1840)*	3	1	3	9	2	0	2.3	2.4	2.3

#### Responses to University-wide questions about the instructor:

	SA	A	N	D	SD	N/A	Your Median	Univ-wide Median	School/College Median
Overall, Benjamin Kuipers was an excellent teacher.(Q2)	13	5	0	0	0	0	4.8	4.6	4.5
Benjamin Kuipers seemed well prepared for class meetings.(Q230)	16	2	0	0	0	0	4.9	4.8	4.7
Benjamin Kuipers explained material clearly.(Q199)	10	8	0	0	0	0	4.6	4.7	4.6
Benjamin Kuipers treated students with respect.(Q217)	16	2	0	0	0	0	4.9	4.8	4.8

#### Responses to questions about the course:

	SA	A	N	D	SD	N/A	Your Median	University-Wide Median
Prerequisites provided adequate preparation for this course. (Q61)	11	1	0	0	0	5	5.0	4.3
The textbook made a valuable contribution to the course. (Q64)	3	2	2	0	0	11	4.3	3.6
I felt included and valued when working with other students. (Q253)	11	2	3	2	0	0	4.7	4.6
I felt comfortable asking questions in class. (Q521)	10	5	1	2	0	0	4.6	4.2
I developed confidence in my abilities as an engineer. (Q1769)	6	5	6	0	0	1	4.0	4.1
I developed the ability to solve real world engineering problems. (Q1770)	9	5	3	1	0	0	4.5	4.1

University of Michigan  
 Winter 2021 Instructor Report With Comments  
 ROB 599 001 - EECS 498 001 - EECS 598 001  
 Benjamin Kuipers

11 out of 31 students responded to this evaluation.

**Responses to University-wide questions about the course:**

	SA	A	N	D	SD	N/A	Your Median	Univ-wide Median	School/College Median
This course advanced my understanding of the subject matter. (Q1631)	5	5	0	0	0	0	4.5	4.6	4.6
My interest in the subject has increased because of this course. (Q1632)	6	4	1	0	0	0	4.6	4.3	4.5
I knew what was expected of me in this course.(Q1633)	8	3	0	0	0	0	4.8	4.6	4.5
Overall, this was an excellent course.(Q1)	8	2	1	0	0	0	4.8	4.4	4.5
I had a strong desire to take this course.(Q4)	7	2	1	1	0	0	4.7	4.1	4.5
As compared with other courses of equal credit, the workload for this course was (SA=Much Lighter, A=Lighter, N=Typical, D=Heavier, SD=Much Heavier). (Q891)	1	5	5	0	0	0	3.6	2.9	2.9
How did you participate in this course? (SA=Attended most synchronously, A=Attended most asynchronously, N=Attended most in person, D=Attended some in person and some online) (Q1854)	10	1	0	0	0	0	5.0	4.8	4.7

**Responses to University-wide questions about the instructor:**

	SA	A	N	D	SD	N/A	Your Median	Univ-wide Median	School/College Median
Overall, Benjamin Kuipers was an excellent teacher.(Q2)	8	3	0	0	0	0	4.8	4.7	4.7
Benjamin Kuipers seemed well prepared for class meetings.(Q230)	7	4	0	0	0	0	4.7	4.8	4.8
Benjamin Kuipers explained material clearly.(Q199)	9	2	0	0	0	0	4.9	4.7	4.7
Benjamin Kuipers treated students with respect.(Q217)	10	1	0	0	0	0	5.0	4.9	4.9

**Responses to questions about the course:**

	SA	A	N	D	SD	N/A	Your Median	University-Wide Median
I gained a good understanding of concepts/principles in this field. (Q121)	7	4	0	0	0	0	4.7	4.5
The amount of work required was appropriate for the credit received. (Q239)	8	3	0	0	0	0	4.8	4.3
Grades were assigned fairly and impartially. (Q365)	7	3	0	0	0	0	4.8	4.6

University of Michigan  
 Winter 2022 Instructor Report With Comments  
 EECS 498 001 - EECS 598 001 - ROB 599 004  
 Benjamin Kuipers

28 out of 33 students responded to this evaluation.

**Responses to University-wide questions about the course:**

	SA	A	N	D	SD	N/A	Your Median	Univ-wide Median	School/College Median
This course advanced my understanding of the subject matter. (Q1631)	17	9	0	1	0	1	4.7	4.6	4.5
My interest in the subject has increased because of this course. (Q1632)	15	11	1	0	0	1	4.6	4.2	4.2
I knew what was expected of me in this course.(Q1633)	14	10	2	1	0	1	4.5	4.6	4.4
I had a strong desire to take this course.(Q4)	12	10	4	1	0	1	4.4	4.1	4.1
As compared with other courses of equal credit, the workload for this course was (SA=Much Lighter, A=Lighter, N=Typical, D=Heavier, SD=Much Heavier). (Q891)	3	14	9	1	0	1	3.8	3.0	3.0

**Responses to University-wide questions about the instructor:**

	SA	A	N	D	SD	N/A	Your Median	Univ-wide Median	School/College Median
Benjamin Kuipers seemed well prepared for class meetings.(Q230)	13	12	1	0	0	1	4.5	4.8	4.7
Benjamin Kuipers explained material clearly.(Q199)	16	8	1	1	0	1	4.7	4.7	4.7
Benjamin Kuipers treated students with respect.(Q217)	22	4	1	0	0	1	4.9	4.8	4.8

**Responses to questions about the course:**

	SA	A	N	D	SD	N/A	Your Median
Overall, this was an excellent course. (Q1)	15	10	2	0	0	1	4.6
Prerequisites provided adequate preparation for this course. (Q61)	12	6	3	0	0	7	4.6
The textbook made a valuable contribution to the course. (Q64)	7	6	0	0	0	14	4.6
I felt included and valued when working with other students. (Q253)	12	9	1	0	0	5	4.6
I felt comfortable asking questions in class. (Q521)	15	9	1	0	0	2	4.7
I developed confidence in my abilities as an engineer. (Q1769)	9	12	2	1	0	3	4.3
I developed the ability to solve real world engineering problems. (Q1770)	8	10	2	3	1	2	4.1

**Responses to questions about the instructor:**

	SA	A	N	D	SD	N/A	Your Median
Overall, Benjamin Kuipers was an excellent teacher. (Q2)	15	9	2	0	0	0	4.6





**Course Approval Request Form**  
Office of the Registrar, University of Michigan

1210 LSA Building  
500 S. State Street  
Ann Arbor, MI 48109-1382  
Phone: 734.763.2113  
Fax: 734.936.3148  
ro.curriculum@umich.edu  
ro.umich.edu

**CHECK APPROPRIATE BOXES FOR ALL CHANGES**

Action Requested

- New Course
- Modification of Existing Course
- Deletion of Existing Course

Date of Submission: 2023-03-24  
Effective Term: Winter 2024

<input type="checkbox"/>	Course Offered <input checked="" type="checkbox"/> Indefinitely <input type="checkbox"/> One term only	<b>RO USE ONLY</b> Date Received: Date Completed: Completed By:
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**CURRENT LISTING**

**REQUESTED LISTING**

<input type="checkbox"/>	Dept (Home): Elec Engin & Computer Sci			Dept (Home): Elec Engin & Computer Sci		
<input type="checkbox"/>	Subject: EECS			Subject: EECS		
<input type="checkbox"/>	Catalog: 402			Catalog: 402		
<input type="checkbox"/>	<input type="checkbox"/> Course is Cross-Listed with Other Departments			<input type="checkbox"/> Course is Cross-Listed with Other Departments		
<input type="checkbox"/>	Department	Subject	Catalog Number	Department	Subject	Catalog Number
<input type="checkbox"/>						
<input type="checkbox"/>	Course Title (full title) Computer Programming For Scientists and Engineers			Course Title (full title) Computer Programming For Scientists and Engineers		
<input type="checkbox"/>	Abbreviated Title (20 char) Prog For Sci/Eng			Abbreviated Title (20 char) Prog For Sci/Eng		
<input checked="" type="checkbox"/>	Course Description (Please limit to 50 words and attach separate sheet if necessary) Presents concepts and hands-on experience for designing and writing programs using one or more programming languages currently important in solving real-world problems. Intended for graduate students in science or engineering fields. Not available for credit to undergraduate students; will not substitute for Eng. 101.					
<input type="checkbox"/>	Full Term Credit Hours			Half Term Credit Hours		
<input type="checkbox"/>	Undergraduate Min: 4	Graduate Min: 4		Undergraduate Min:	Graduate Min:	
<input type="checkbox"/>	Undergraduate Max: 4	Graduate Max: 4		Undergraduate Max:	Graduate Max:	
<input type="checkbox"/>	Course Credit Type Undergraduate Student, Rackham Graduate Student, Non-Rackham Graduate Student					
<input type="checkbox"/>	Repeatability					
<input type="checkbox"/>	<input type="checkbox"/> Course is Repeatable for Credit			<input type="checkbox"/> Course is Y graded		
<input type="checkbox"/>	Maximum number of repeatable credits:			<input type="checkbox"/> Can be taken more than once in the same term		

Subject: Elec Engin &amp; Computer Sci Catalog: 402

<input type="checkbox"/>	Grading Basis		
	<input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration	Add Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent	Drop Consent <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent
<input type="checkbox"/>	Grading		
	<input type="checkbox"/> Not for Credit		
	<input type="checkbox"/> Not for Degree Credit		
	<input type="checkbox"/> Degree Credit Only		

CURRENT LISTING		REQUESTED LISTING
<input type="checkbox"/>	Advisory Prerequisite (254 char)	Advisory Prerequisite (254 char)
<input checked="" type="checkbox"/>	Enforced Prerequisite (254 char) Senior or graduate standing Minimum grade requirement: C	Enforced Prerequisite (254 char) Graduate standing Minimum grade requirement:
<input type="checkbox"/>	Credit Exclusions No credit granted for EECS 402 if student has credit for or is currently enrolled in EECS 180, EECS 183, ENGR 101, ENGR 151, EECS 280 or EECS 282.	Credit Exclusions No credit granted for EECS 402 if student has credit for or is currently enrolled in EECS 180, EECS 183, ENGR 101, ENGR 151, EECS 280 or EECS 282.
<input type="checkbox"/>	Course Components <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Discussion <input type="checkbox"/> Independent Study	Graded Component <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
		Terms Typically Offered <input checked="" type="checkbox"/> Fall <input checked="" type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer
Cognizant Faculty Member Name: Andrew Morgan		Cognizant Faculty Member Title:

**SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED (Please Print AND Sign Name)**

Contact Person: Punam Vyas

Email: vyas@umich.edu

Phone: 647-1754

CoE Curriculum

Committee Representative:



Print: Amir Kamil

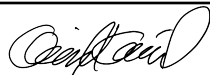
Date: 3/24/23

CoE Curriculum Committee Chair:

Print:

Date:

Home Department Chair:



Print: Amir Kamil

Date: 3/24/23

Cross-Listed Department Chair:

Print:

Date:

Cross-Listed Department Chair:

Print:

Date:

Cross-Listed Department Chair:

Print:

Date:

## DEPARTMENTAL/COLLEGE USE ONLY

**Current:****Requested:**Course Description

Presents concepts and hands-on experience for designing and writing programs using one or more programming languages currently important in solving real-world problems. Intended for senior undergraduates and graduate students in science or engineering fields. Not available for credit to EECS majors; will not substitute for Eng. 101.

Course Description

Presents concepts and hands-on experience for designing and writing programs using one or more programming languages currently important in solving real-world problems. Intended for graduate students in science or engineering fields. Not available for credit to undergraduate students; will not substitute for Eng. 101.

Class Length

Full term

Class Length

Full term

Contact hours (lecture):

3

Contact hours (lecture):

3

Contact hours (recitation)

1

Contact hours (recitation)

1

Contact hours (lab)Contact hours (lab)**Additional Info:**Submitted by:

Home dept

Describe how this course fits with the degree requirements:Special resources of facilities required for this course:Supporting statement:

EECS 402 is designed as an introductory programming course for graduate students. Undergraduates should take ENGR 101 or EECS 183 instead. We are updating the course description and prerequisites to reflect this.



## Course Approval Request Form

Office of the Registrar, University of Michigan

1210 LSA Building

500 S. State Street

Ann Arbor, MI 48109-1382

Phone: 734.763.2113

Fax: 734.936.3148

ro.curriculum@umich.edu

ro.umich.edu

CHECK APPROPRIATE BOXES FOR ALL CHANGES

### Action Requested

- New Course  
 Modification of Existing Course  
 Deletion of Existing Course

Date of Submission: 2023-03-22

Effective Term: Winter 2024

<input checked="" type="checkbox"/>	Course Offered <input checked="" type="checkbox"/> Indefinitely <input type="checkbox"/> One term only	<b>RO USE ONLY</b> Date Received: Date Completed: Completed By:
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### CURRENT LISTING

### REQUESTED LISTING

<input checked="" type="checkbox"/>	Dept (Home): Subject: Catalog:	Dept (Home): Material Science Engineering Subject: MATSCIE Catalog: 281												
<input type="checkbox"/>	<input type="checkbox"/> Course is Cross-Listed with Other Departments	<input checked="" type="checkbox"/> Course is Cross-Listed with Other Departments												
<input checked="" type="checkbox"/>	<table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td>Anthropology Archaeology - ANTHRARC - 281</td> </tr> </tbody> </table>	Department	Subject	Catalog Number			Anthropology Archaeology - ANTHRARC - 281	<table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 25%;">Department</th> <th style="width: 25%;">Subject</th> <th style="width: 50%;">Catalog Number</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td>Anthropology Archaeology - ANTHRARC - 281</td> </tr> </tbody> </table>	Department	Subject	Catalog Number			Anthropology Archaeology - ANTHRARC - 281
Department	Subject	Catalog Number												
		Anthropology Archaeology - ANTHRARC - 281												
Department	Subject	Catalog Number												
		Anthropology Archaeology - ANTHRARC - 281												
<input checked="" type="checkbox"/>	Course Title (full title)	Course Title (full title) Making Things: Three Million Years of Materials and Culture												
<input checked="" type="checkbox"/>	Abbreviated Title (20 char)	Abbreviated Title (20 char) Making Things												
<input checked="" type="checkbox"/>	Course Description (Please limit to 50 words and attach separate sheet if necessary) Connections between the discovery of new materials - such as ceramics, concrete, precious stones and metals, glass, steel, plastics, and semiconductors - and social transformations worldwide. To see these connections, the course will fuse basic concepts in materials science and engineering with perspectives and methods from anthropological archaeology. Students will learn how the physical properties of different materials intersect with cultural variables like gender, race, power/authority, religious beliefs, values, and financial and political systems to shape human civilization.													
<input checked="" type="checkbox"/>	Full Term Credit Hours Undergraduate Min: 3      Graduate Min: Undergraduate Max: 3      Graduate Max:	Half Term Credit Hours Undergraduate Min:      Graduate Min: Undergraduate Max:      Graduate Max:												
<input checked="" type="checkbox"/>	Course Credit Type Undergraduate Student													
<input type="checkbox"/>	Repeatability <input type="checkbox"/> Course is Repeatable for Credit Maximum number of repeatable credits:	<input type="checkbox"/> Course is Y graded <input type="checkbox"/> Can be taken more than once in the same term												

	Subject:	Catalog:
<input checked="" type="checkbox"/>	<b>Grading Basis</b> <input checked="" type="checkbox"/> Graded (A – E) <input type="checkbox"/> Credit/No Credit <input type="checkbox"/> Satisfactory/Unsatisfactory <input type="checkbox"/> Pass/Fail <input type="checkbox"/> Business Administration <b>Grading</b> <input type="checkbox"/> Not for Credit <input type="checkbox"/> Not for Degree Credit <input type="checkbox"/> Degree Credit Only	
	<b>Add Consent</b> <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent	<b>Drop Consent</b> <input type="checkbox"/> Department Consent <input type="checkbox"/> Instructor Consent <input checked="" type="checkbox"/> No Consent

	CURRENT LISTING	REQUESTED LISTING			
<input type="checkbox"/>	Advisory Prerequisite (254 char)	Advisory Prerequisite (254 char)			
<input type="checkbox"/>	Enforced Prerequisite (254 char)	Enforced Prerequisite (254 char)			
<input type="checkbox"/>	Minimum grade requirement:	Minimum grade requirement:			
<input type="checkbox"/>	Credit Exclusions	Credit Exclusions			
<input checked="" type="checkbox"/>	<table style="width:100%; border: none;"> <tr> <td style="width:33%; border: none;"> <b>Course Components</b>  <input checked="" type="checkbox"/> Lecture  <input type="checkbox"/> Seminar  <input type="checkbox"/> Recitation  <input type="checkbox"/> Lab  <input type="checkbox"/> Discussion  <input type="checkbox"/> Independent Study         </td> <td style="width:33%; border: none;"> <b>Graded Component</b>  <input checked="" type="checkbox"/>  <input type="checkbox"/>  <input type="checkbox"/>  <input type="checkbox"/>  <input type="checkbox"/>  <input type="checkbox"/> </td> <td style="width:33%; border: none;"> <b>Terms Typically Offered</b>  <input type="checkbox"/> Fall  <input checked="" type="checkbox"/> Winter  <input type="checkbox"/> Spring  <input type="checkbox"/> Summer  <input type="checkbox"/> Spring/Summer         </td> </tr> </table>		<b>Course Components</b> <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study	<b>Graded Component</b> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<b>Terms Typically Offered</b> <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer
<b>Course Components</b> <input checked="" type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Recitation <input type="checkbox"/> Lab <input type="checkbox"/> Discussion <input type="checkbox"/> Independent Study	<b>Graded Component</b> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<b>Terms Typically Offered</b> <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <input type="checkbox"/> Spring/Summer			
Cognizant Faculty Member Name: Steven Yalisove					
Cognizant Faculty Member Title:					

**SIGNATURES ARE REQUIRED FROM ALL DEPARTMENTS INVOLVED (Please Print AND Sign Name)**

Contact Person: Steven M. Yalisove Email: smy@umich.edu Phone: 734-255-6987

CoE Curriculum Committee Representative:  Print: Steven M. Yalisove Date: 03-27-23

CoE Curriculum Committee Chair: \_\_\_\_\_ Print: \_\_\_\_\_ Date: \_\_\_\_\_

Home Department Chair:  Print: Elizabeth A. Holm Date: 3/27/2023

Cross-Listed Department Chair:  Print: Kelly Askew Date: 3/28/2023

Cross-Listed Department Chair: \_\_\_\_\_ Print: \_\_\_\_\_ Date: \_\_\_\_\_

Cross-Listed Department Chair: \_\_\_\_\_ Print: \_\_\_\_\_ Date: \_\_\_\_\_

**DEPARTMENTAL/COLLEGE USE ONLY**

**Current:****Requested:**Course DescriptionCourse Description

Connections between the discovery of new materials - such as ceramics, concrete, precious stones and metals, glass, steel, plastics, and semiconductors - and social transformations worldwide. To see these connections, the course will fuse basic concepts in materials science and engineering with perspectives and methods from anthropological archaeology. Students will learn how the physical properties of different materials intersect with cultural variables like gender, race, power/authority, religious beliefs, values, and financial and political systems to shape human civilization.

Class LengthClass Length

Full term

Contact hours (lecture):Contact hours (lecture):

3

Contact hours (recitation)Contact hours (recitation)Contact hours (lab)Contact hours (lab)**Additional Info:**Submitted by:

Home dept

Describe how this course fits with the degree requirements:

Will be used to help recruit students to our program and also count as a social science course for intellectual breadth.

Special resources of facilities required for this course:Supporting statement:

This cross listed course will help put Materials Science and Engineering into a broader context to relate the development of culture with materials science and engineering.

# Grading for the course

## The course will be graded as follows:

Weekly individual homework:	(40%)
Flipped Learning Section: Attendance and participation are required	(20%)
Team produced poster at end of class	(10%)
Self Evaluation/Reflection 1:	(15%)
Self Evaluation/Reflection 2:	(15%)

**There will be NO Final exam**

## Course schedule and topics taught:

- **This is the Front Page of our Canvas site which serves as the Syllabus:**
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- **ANTHRARC 296/MATSCIE 293**

**MAKING THINGS: THREE MILLION YEARS OF MATERIALS AND CULTURE**

**3 CREDITS**

Winter 2023

MWF, 11:00-12:00 in person in room 2460 Central Campus Classroom Building

Zoom link: <https://umich.zoom.us/j/93204341478> Links to an external site.

A little video about our course:

Making Things: 3 Million Years of Materials and Culture  
- W22 Trailer  
[youtu.be](https://youtu.be/e82iosMorBo)

<https://youtu.be/e82iosMorBo> Links to an external site.

**This is a longer video but fuller description:**

The Meaning of Social Learning: Three Million Years of  
Materials and Culture  
[youtu.be](https://youtu.be)

### **Instructors:**

Prof. Robin Beck Office: 3010 School of Education Building

E-mail: [rabeck@umich.edu](mailto:rabeck@umich.edu) Office hours: Tues, 1:30-2:00 (zoom); Wed. 1:00-2:00; or by appointment

Office phone: (734) 764-1240

and

Prof. Steven Yalisove Office: 2146 H.H. Dow

E-mail: [smy@umich.edu](mailto:smy@umich.edu) Office hours: Mon: 1-2pm (after class in CCCB hallway or via zoom) or by appointment

Office phone (734)-764-4346

### **GSIs:**

Hailey Lovelace

E-mail: [hlovela@umich.edu](mailto:hlovela@umich.edu) Office Hours: 2pm-3pm on Thursdays or by Appointment  
Office: 2062 HH Dow - 11A

Zoom Office Hours Link: <https://umich.zoom.us/j/99799561118> Links to an external site.

Kara Larson

E-mail: [larsonkm@umich.edu](mailto:larsonkm@umich.edu) Office hours: Mon: 2pm-3pm in Chem 3250 or via zoom  
OR by appointment

Zoom Office Hours Link: <https://umich.zoom.us/j/3613390400> Links to an external site.

### **COURSE DESCRIPTION**

This course explores the connections between the discovery of new materials -- such as ceramics, concrete, precious stones and metals, glass, steel, plastics, and semiconductors -- and social transformations worldwide. To see these connections, the course will fuse basic concepts in materials science and engineering with perspectives and methods from anthropological archaeology. From ancient cities and Roman baths, to steel foundries and Tupperware parties, to virtual communities and nanomedicine, we will learn how the physical properties of different materials



intersect with cultural variables like gender, race, power/authority, religious beliefs, values, and financial and political systems to shape human civilization. By connecting lessons from the past to the inventions of cutting-edge materials, we will also explore the future social impacts of new materials in medicine, construction, transportation, clean energy, sports, and other areas. This course will explore both how materials shape society and how society shapes material innovations.

### **EVALUATION METHOD**

Weekly individual homework: (40% total)

Flipped Learning Section: Attendance and participation are required (20% total)

Team produced poster at end of class (10%)

Two Self Evaluation/Reflections: (15% each).

There will be NO Final exam.

### **LATE HOMEWORK POLICY**

Homework is generally due each week **before** the beginning of the Friday session. Pay attention to each assignment due date and note exceptions. Late homework will lose points according to the following policy:

- 10% deduction on assignments turned in within the first 24-hour window after the assignment is due.
- Another 10% will be deducted for each additional day late. Missing homework will eventually result in a 0.
- If you fall far behind on homework, please reach out to either the professors or your GSI, and we will talk about options.

Remember, doing your homework on time is critical to being prepared for the Friday activity, so not doing the homework may also result in negative impacts on your participation score.

### **READING**

#### **Assigned textbooks:**

**The Substance of Civilization: Materials and Human History from the Stone Age to the Age of Silicon, Stephen Sass, Arcade Publishing, 2011.**

This is available at the UM library as an online digital book (only 2 copies) via the Hathi Trust Library for free this term ([video showing how to access it](#))[Links to an external site.](#). You can also purchase a paper copy from Amazon for \$19.99 or a Kindle version for \$10.99.

**Impact of Materials on Society, Sophia Krzys Acord, Kevin S. Jones, Sean Adams, Marsha Bryant, Florin Curta, Mary Ann Eaverly, Bonnie Effros, Susan D. Gillespie, and Kenneth E. Sassaman**

This is a free web based text that is accessed at the following link. PDF versions of selected portions of the book will also be available in the Canvas modules.

[https://ufl.pb.unizin.org/imos/front-matter/publication-information/Links to an external site.](https://ufl.pb.unizin.org/imos/front-matter/publication-information/Links%20to%20an%20external%20site)

Plus selected readings will be assigned as the course progresses.

## **PERSONAL BIOS**

Robin Beck is an archaeologist who studies social change and cultural complexity among prehistoric and early colonial period societies in the New World. He has directed projects in Highland Bolivia and western North Carolina, and has also worked in Peru, China, and much of the Eastern United States.

Steve Yalisove is a materials scientist who studies ultrafast laser solid interaction. He makes his materials using thin film methods such as sputter deposition or molecular beam epitaxy for all of his experience. He characterizes his materials before and after laser irradiation using a wide variety of tools such as Transmission and Scanning Electron Microscopy, several spectroscopies, X-ray diffraction, as well as many time resolved techniques. His focus is on the way materials behave in extreme environments from the atomic scale to the macro scale.

Hailey Lovelace is a second-year graduate student in the University of Michigan Materials Science and Engineering Department. She has a background in physics from Clemson University. Her current research uses fabrication methods to design materials with specific optical and electrical properties, or metamaterials, for uses in energy and information. She is studying the material properties of indium and indium nitride nanoparticle arrays on silicon. She is also interested in using weak topological insulators with specifically designed defects for quantum computing. Hailey has previously taught introductory physics labs (Physics 141 and 251) and an introductory materials science course (MSE 220).

Kara Larson is in her third year of her PhD in Archaeology at Michigan. Her research explores the origins of urbanism in marginal locales in the Southern Levant during the Early Bronze Age through stable isotopic analyses, proteomics, and zooarchaeology. She is interested in the intersection of herd management strategies, dietary subsistence, and prehistoric economies. She has worked on projects in Israel, Jordan, Egypt, Greece, Croatia, Kazakhstan, Mongolia, and the Southeastern United States. She is a first-gen scholar, and received an undergraduate degree in anthropology from Grand Valley State University and an M.A. from Mississippi State University in applied anthropology before coming to UMich.

## **POLICIES ON ZOOM VIDEOCONFERENCING**

The Monday and Wednesday classes will be in-person lectures that can also be followed synchronously in zoom by students unable to attend in person due to illness. You **MUST** let BOTH GSIs know that you are ill and explain why you cannot attend, at least 1 hour before class starts. Then we will permit you to access the class via zoom. We will be as accommodating as possible and thank you in advance for not coming to class if you do not feel well. All lectures will be recorded for later viewing, but without the opportunity to ask questions synchronously during class.

The flipped class activity will also be in-person, **but attendance will be required as you will work with your groups**. These flipped activities will NOT be recorded, but if you are ill and let the GSIs know at least 1 hour in advance, we will allow you to zoom into your team (each team will set up these special sessions by themselves).

**Policy for Excused Absence from Friday Sessions:**

If there is no way to participate, even by zoom, then we expect you to do your best to help your team by attempting to complete the Friday activity by yourself and sending your work to the team Thursday night. This way they can use your ideas during their team session. You must also send Hailey and Kara the documents Thursday evening so that they can give you credit for “participating”.

MATSCIE 293 /ANTHRARC 296 Making Stuff: Three Million Years of Materials and Culture Winter 2023 Schedule and Syllabus All Reading Assignments are posted on the Canvas Modules Pages				
Month	Module	Date	Module	Topic
Jan.	1	Wed. 4	Intro	Introduction to materials and why they matter
		Fri. 6	Intro	Introduction to the Impact Paradigm, and the physical and social properties of materials
	2	Mon. 9	Clay	Materials lecture on Clay
		Wed. 11		Archaeology lecture on the Age of Clay
		Fri. 13		Flipped Classroom – <b>Rare Earths</b>
		Mon. 16		MLK day
	3	Wed. 18	Ceramics and Glass	Materials lecture on glass and ceramics Archaeology lecture on Obsidian to Porcelain and Early Materials Manipulation
		Fri. 20		Flipped Classroom – <b>Functional Ceramics</b>
	4	Mon. 23	Copper and Bronze	Materials lecture on copper and bronze
		Wed. 25		Archaeology lecture on The Bronze Age
		Fri. 27		Flipped Classroom - <b>Photovoltaics</b>
	5	Mon. 30	Concrete	Materials introduction to concrete
Feb.		Wed. 1		Archaeology lecture on the pre-history of concrete
		Fri. 3	Concrete activity,	Flipped Classroom – <b>New Building Materials</b>
	6	Mon. 6	Gold and Silver	Materials introduction to gold and silver
		Wed. 8		Archaeology lecture on precious metals and inequality
		Fri. 10	Gold and Silver activity	Flipped Classroom – <b>Gold Nanoparticles</b>
	7	Mon. 13	Iron and Steel	Materials introduction to iron and steel
		Wed. 15		Archaeology lecture on origins of iron
		Fri. 17		Flipped Classroom – <b>Magnesium Alloys</b>
	8	Mon. 20	How to critique yourself and others	How to critique your self-assessment/reflections. How to help others in your group improve their understanding of the material. <b>This will not be recorded and you must be present but it is ok to be remote.</b>
		Wed. 22	Self-assessment/reflection critique activity	Group activity to share self-assessments/reflections and improve your understanding. (Individual self-assessments due on Canvas by 11:59PM on February 22nd. Revised self-assessments are due on Friday March 10th before class)- <b>As this is a group activity and we are giving you Friday off, In-Person Attendance is Mandatory</b>
		Fri. 24	Wellness Day	No class
		Mon. 27	Winter Break	No class
Mar.		Wed. 1	Winter Break	No class
		Fri. 3	Winter Break	No class
	9	Mon. 6	Aluminum	Materials introduction to aluminum
		Wed. 8		Archaeology lecture on metallurgy in Asia and Africa
		Fri. 10		Flipped Classroom – <b>Casting of Al</b>
	10	Mon. 13	Plastics	Materials introduction to writing materials
		Wed. 15		Humanities lecture on the creation of Tupperware and postwar America
		Fri. 17		Flipped Classroom – <b>Biopolymers</b>
	11	Mon. 20	Writing Materials	Materials introduction to writing materials
		Wed. 22		Archaeology lecture on the development of writing materials
		Fri. 24		Flipped Classroom – <b>Kelsey museum activity for homework. In-Person attendance required Friday</b>
	12	Mon. 27	Semiconductors	Materials introduction to semiconductors
		Wed. 29		Archaeology lecture on moving information
		Fri. 31		Flipped Classroom – <b>2-D materials</b>
Apr.	13	Mon. 3	Carbon	Materials introduction to Carbon
		Wed. 5		Archaeology lecture on Carbon
		Fri. 7		<b>Attendance is mandatory: Work on Group Project</b>
	14	Mon. 10	Why MSE?	
		Wed. 12	Why Archaeology?	
		Fri. 14	Self-assessment/reflection critique activity	Group activity to share self-assessments/reflections and improve your understanding. (Individual self-assessments due on Canvas by midnight on April 14th. Self-assessment revisions are due on Monday April 17th at 11:59 PM).
		Mon. 17	Poster Fair	Each team will have 2 minutes to present their poster to the rest of the class.

University of Michigan  
 Winter 2022 Instructor Report With Comments  
 ANTHRARC 296 001 - MATSCIE 293 001  
 Steven Yalisove

39 out of 55 students responded to this evaluation.

**Responses to University-wide questions about the course:**

	SA	A	N	D	SD	N/A	Your Median	Univ-wide Median	School/College Median
This course advanced my understanding of the subject matter. (Q1631)	17	21	0	0	0	0	4.4	4.6	4.5
My interest in the subject has increased because of this course. (Q1632)	15	15	6	3	0	0	4.2	4.2	4.2
I knew what was expected of me in this course.(Q1633)	26	8	5	0	0	0	4.8	4.6	4.6
I had a strong desire to take this course.(Q4)	10	14	14	1	0	0	3.8	4.1	4.1
As compared with other courses of equal credit, the workload for this course was (SA=Much Lighter, A=Lighter, N=Typical, D=Heavier, SD=Much Heavier). (Q891)	11	21	6	1	0	0	4.1	3.0	3.3

**Responses to University-wide questions about the instructor:**

	SA	A	N	D	SD	N/A	Your Median	Univ-wide Median	School/College Median
Steven Yalisove seemed well prepared for class meetings.(Q230)	26	12	1	0	0	0	4.8	4.8	4.8
Steven Yalisove explained material clearly.(Q199)	27	9	2	1	0	0	4.8	4.7	4.7
Steven Yalisove treated students with respect.(Q217)	25	10	3	0	0	0	4.7	4.8	4.9

**Responses to questions about the course:**

	SA	A	N	D	SD	N/A	Your Median
I deepened my interest in the subject matter of this course. (Q140)	11	20	1	6	0	0	4.1
Students in this course were free to disagree and ask questions. (Q223)	18	17	4	0	0	0	4.4
The objectives of the course were clearly explained. (Q231)	19	17	2	1	0	0	4.5
Work requirements and grading system were clear from the beginning. (Q232)	21	14	1	3	0	0	4.6
Writing assignments were returned promptly. (Q325)	11	14	10	3	1	0	3.9

**Responses to questions about the instructor:**

	SA	A	N	D	SD	N/A	Your Median
Steven Yalisove stressed important points in lectures/discussions. (Q203)	25	12	1	1	0	0	4.7
Steven Yalisove was enthusiastic. (Q204)	23	12	3	1	0	0	4.7
Steven Yalisove was willing to meet and help students outside class. (Q219)	20	7	7	0	0	5	4.7
Steven Yalisove suggested specific ways students could improve. (Q224)	23	14	1	1	0	0	4.7
Steven Yalisove encouraged student participation in an equitable way. (Q244)	23	13	2	1	0	0	4.7

University of Michigan  
 Winter 2021 Instructor Report With Comments  
 ANTHRARC 296 001 - MATSCIE 293 001  
 Steven Yalisove

39 out of 49 students responded to this evaluation.

**Responses to University-wide questions about the course:**

	SA	A	N	D	SD	N/A	Your Median	Univ-wide Median	School/College Median
This course advanced my understanding of the subject matter. (Q1631)	18	19	1	0	0	0	4.4	4.6	4.6
My interest in the subject has increased because of this course. (Q1632)	14	18	5	2	0	0	4.2	4.3	4.3
I knew what was expected of me in this course.(Q1633)	19	12	7	1	0	0	4.5	4.6	4.7
Overall, this was an excellent course.(Q1)	18	15	5	1	0	0	4.4	4.4	4.5
I had a strong desire to take this course.(Q4)	13	15	10	1	0	0	4.1	4.1	4.2
As compared with other courses of equal credit, the workload for this course was (SA=Much Lighter, A=Lighter, N=Typical, D=Heavier, SD=Much Heavier). (Q891)	2	21	15	1	0	0	3.7	2.9	3.2
How did you participate in this course? (SA=Attended most synchronously, A=Attended most asynchronously, N=Attended most in person, D=Attended some in person and some online) (Q1854)	29	9	0	1	0	0	4.8	4.8	4.9

**Responses to University-wide questions about the instructor:**

	SA	A	N	D	SD	N/A	Your Median	Univ-wide Median	School/College Median
Overall, Steven Yalisove was an excellent teacher.(Q2)	28	9	2	0	0	0	4.8	4.7	4.7
Steven Yalisove seemed well prepared for class meetings.(Q230)	33	6	0	0	0	0	4.9	4.8	4.8
Steven Yalisove explained material clearly.(Q199)	27	10	1	1	0	0	4.8	4.7	4.8
Steven Yalisove treated students with respect.(Q217)	33	6	0	0	0	0	4.9	4.9	4.9

**Responses to questions about the course:**

	SA	A	N	D	SD	N/A	Your Median	University-Wide Median
I deepened my interest in the subject matter of this course. (Q140)	18	13	4	2	0	0	4.5	4.5
Students in this course were free to disagree and ask questions. (Q223)	20	17	2	0	0	0	4.5	4.7
The objectives of the course were clearly explained. (Q231)	18	18	2	1	0	0	4.4	4.7
Work requirements and grading system were clear from the beginning. (Q232)	18	16	5	0	0	0	4.4	4.7
Writing assignments were returned promptly. (Q325)	12	18	5	1	0	2	4.2	4.6

**Responses to questions about the instructor:**

	SA	A	N	D	SD	N/A	Your Median	University-Wide Median
Steven Yalisove stressed important points in lectures/discussions. (Q203)	22	13	3	1	0	0	4.6	4.7
Steven Yalisove was enthusiastic. (Q204)	28	11	0	0	0	0	4.8	4.8
Steven Yalisove was willing to meet and help students outside class. (Q219)	20	15	2	0	0	2	4.6	4.8
Steven Yalisove suggested specific ways students could improve. (Q224)	17	13	5	1	0	3	4.4	4.8
Steven Yalisove encouraged student participation in an equitable way. (Q244)	22	10	5	0	0	1	4.7	4.8

The medians are calculated from Winter 2021 data. University-wide medians are based on all UM classes in which an item was used. The school/college medians in this report are based on classes that are lower division with enrollment of 16 to 74 in Division of Social Sciences in the College of LS&A.