



SYS 30000 It's a Complex World: Addressing Global Challenges – Spring 2024

This syllabus is subject to change with notice. For the most recent updates see <https://purdue.brightspace.com>

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Office: Grissom Hall, third floor (372)

Office Hours: Tuesdays/Thursdays 12:00-1:00 pm or by appointment (I will be also available to meet online if requested), here is the online link:

<https://purdue-edu.zoom.us/j/6512389273?pwd=eXB4Uj9NMkRHU2xUdHVzemcrYnhpQT09>

When contacting via email. Please always use “SYS300 Question” as the email subject line.

Course Information: SYS 30000 It's a Complex World: Addressing Global Challenges

Time: T, Th 9:00 am- 10:15 am

Location: WALC 1121

Instructional Modality: Face-to-Face

Course credit hours: 3 credit hours

Prerequisites: No prerequisites are required.

This course uses Brightspace, if you do not have access, please contact me ASAP!

Course Description

The main goal of this course is to use the ideas and tools of complex adaptive systems to address grand challenges that are of global concern—such as environmental sustainability and energy use, natural and human disasters, and political and economic development. The course exploits these challenges from diverse disciplinary perspectives, from the biological and physical sciences to the social sciences, to engineering. Through case studies and computer simulation, students will analyze the features of these challenges which make them ‘complex,’ and seek to explain and find solutions to the problems that arise in each case. Their treatment of the cases will be informed by published research. Students will actively participate in

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discussions regarding these global challenges and contribute to the progress of the class using oral and written presentations. The course will culminate with a final project.

Course Goals

The main goal of this course is to prepare students to use the perspective of “complex adaptive systems” to analyze and solve real-world problems.

Learning Outcomes

- 1) Identify and evaluate global challenges using engineering, biological, physical, environmental, and social scientific perspectives, including attention to the interdependence of the different perspectives.
- 2) Apply the concepts and tools of complexity research to develop a group-based project of comprehensive policies/solutions/strategies in a new and unresolved problem area.
- 3) Demonstrate fundamental proficiency in applying computer modeling to synthesize the behavior of complex systems, with applications to global challenges.
- 4) Effectively work with teams from diverse backgrounds.

Class Schedule

Week	Date	Topic
UNIT 1: Introduction to Systems / Climate Change		
1	Tu 1/9	Introduction to the class and syllabus
1	Th 1/11	Introduction to Systems
2	Tu 1/16	Key Properties of Systems
2	Th 1/18	System Classification
3	Tu 1/23	Climate Change: A Systems Perspective
3	Th 1/25	En-ROADS Simulation Set-up
4	Tu 1/30	En-ROADS Simulation
UNIT 2: Modeling and Simulation		
4	Th 2/1	Introduction to Modeling and Simulation
5	Tu 2/6	Agent-Based Models
5	Th 2/8	Introduction to Netlogo and Netlogo Tutorial
6	Tu 2/13	Top-Down Modeling
6	Th 2/15	Bottom-up Modeling
7	Tu 2/20	Final Discussion
UNIT 3: Networks		
7	Th 2/22	Networks Intro
8	Tu 2/27	Networks
8	Th 2/29	Networks
9	Tu 3/5	Networks Data Analysis

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9	Th 3/7	Networks Data Analysis and Contagion
10	Tu 3/12	Spring Break- No Classes
UNIT 4: Decision-Making for Complex Systems		
10	Th 3/14	Spring Break- No Classes
11	Tu 3/19	Introduction to Decision-Making in Complex Systems
11	Th 3/21	Stakeholders and Framing Decision Opportunities
11	Tu 3/26	Multi-attribute Decision Making
12	Th 3/28	Introduction to System Modeling for Decision Making
12	Tu 4/2	Introduction to Decision-Making for Complex Systems
UNIT 5: Game Theory		
13	Th 4/4	From Single Decision-Maker to Games
14	Tu 4/9	Fundamentals of Game Theory
14	Th 4/11	Nash Equilibrium
15	Tu 4/16	Pure and Mixed Strategies
15	Th 4/18	Intro to Game theory for Complex Systems
Student Project Presentations		
16	4/23-25	Final project presentations

* Schedule and assignments are subject to change. Any changes will be posted in the learning management system.

Purdue [Academic Calendar](#) and key University dates for the Spring 2024 semester, such as:

- Jan 8 – Classes Begin**
- Jan 15 – Martin Luther King Jr. Day (No Classes)**
- Mar 11-16 – Spring Break (No Classes)**
- April 27 – Classes End**
- May 1-4 – Final Exams**
- May 7 – Grades Due**

The final date to withdraw from a course with a W for Spring 2024 is Friday, April 12.

Tentative Assignment Schedule for SYS 300 - Spring 2024

Assignment	Due Date	Group or Individual Score
Assignment 1	Jan 23rd	Individual
Assignment 2	Feb 6th	Group
Assignment 3	Feb 29th	Individual
Assignment 4	March 26th	Individual
Final Project Proposal	March 19th	Group
Assignment 5	April 4th	Group
Assignment 6	April 18th	Individual
Final Project Slides	April 23rd	Group
Final Project Report	April 28 th	Group

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Course Requirements

Class Policies

Late Policy:

Day #1- 15% off the earned score on the assignment.

Day #2- 30% is now deducted from the earned score.

Day #3- 50% is deducted from the earned score.

Day #4- The assignment is counted as a zero.

***This policy does not apply for illness unless the assignment is not made up within the allotted time given specifically for illness. To receive full credit on a late assignment, the student must arrange late submission before the due date with the instructor.

Class Readings & Assignments

You are expected to complete the assigned readings (as listed in your Class Schedule) for the corresponding class meetings. Since unexpected events may occur (e.g., school cancellations), the class schedule is tentative, and I reserve the right to make any changes throughout the semester. If any change occurs to the class schedule, you will be notified in a timely manner, so you can plan accordingly.

Remember, an emergency on your part does not make it an emergency on mine. Please do not procrastinate. All the readings and assignments are laid out for you, so keep up in class because you never know when something you cannot control will happen (that is to say, you get sick, someone passes away, etc.).

Re-Grading Policies

1. A student wishing to request a re-grade for any coursework should return their paper with a written statement explaining the re-grade request. Any re-grade request must be submitted no later than one week after the material was returned to the student.
2. Any work returned for a re-grade may be totally re-graded, not merely those portions which the person wishes to be re-graded.
3. Discussion of corrected assignments, and exams, as opposed to requests for re-grades, may be done during office hours or by appointment.
4. According to University regulations, only final course grades can be “appealed.” There is a formal University timetable and process for grade appeals. It must be followed exactly! Questions about grade appeals should be directed to the Department Head of the School of Industrial Engineering or the Chair of the College of Engineering Grade Appeals Committee.

Required Texts

Readings will be made available on the course website on Bright Space before the relevant class session. They are to be completed before class on the due date.

Required Software

The syllabus is subject to change. All dates are tentative.

- Each student will download NetLogo. It is available free of charge at
 - <https://ccl.northwestern.edu/netlogo/>
- R (statistical computing and programming language) and R Studio (a user interface) are also needed. Both are available for free download at
 - <http://cran.r-project.org/>
 - <http://www.rstudio.com>
 - Several packages on CRAN will need to be installed. Details will be provided in class.
- GeNIe influence diagram software will be available as cloud-based software at
 - <https://goremote.itap.purdue.edu>
 - After logging in with your Career ID, select “Use light version” and search for GeNIe
 - <https://repo.bayesfusion.com/bayesbox.html>
 - This is an interactive repository of GeNIe models

Systems Certificate

This course completes one of the requirements of the Undergraduate Certificate in Systems. For more information about the Systems Certificate, visit <https://www.purdue.edu/collaboratory/>. Ask me or Kat Burkhart (caburkha@purdue.edu) for more information and how to apply.

Grading (subject to change with notice):

Grade Category	
Homework Assignments (Individual and Teamwork)	50%
In-Class Activities	5%
Iclicker Cloud (participation & Attendance)	10%
Final Project Proposal (Teamwork)	5%
Final Project Report (Teamwork)	20%
Final Project Slides/Presentation (Teamwork)	5%
Peer-Review Evaluations (Individual)	5%
TOTAL	(100%)

Letter Grade Calculation

Final letter grades will be assigned as follows:

A+ = 97-100%	B+ = 87-90%	C+ = 77-80%	D+ = 67-70%
A = 93-96%	B = 83-86%	C = 73-76%	D = 63-66%
A- = 90-92%	B- = 80-82%	C- = 70-72%	D- = 60-62%
F = 59% and below			

How to Succeed in this Course

If you want to be a successful student:

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- Be self-motivated and self-disciplined.
- Be willing to speak up if problems arise.
- Access the resources that are available to you; reaching out for assistance is a critical life skill rather than an indication of weakness.
- Be willing and able to commit to 4 to 15 hours per week per course.
- Be able to communicate through writing.
- Be able to meet the minimum requirements for the course.
- Accept critical thinking and decision-making as part of the learning process.
- Take advantage of resources such as those listed in our course Brightspace under Announcements regarding Technology, Academics, Campus Resources, etc.
- Review the University Policies content on our course Brightspace.

In contrast, here are some common behaviors that lead to failing the course.

- Delay reading until the night before the discussion.
- Wait until the last day to begin assignments.
- Forget about deadlines.
- Ignore emails from the instructor and/or your peers regarding course activities.
- Don't get familiar with the course Brightspace and syllabus.

Use of Artificial Intelligence (AI) or Large Language Models (LLM):

ChatGPT and other AI generators that use large language models can be useful for researching and writing papers. However, you should be aware of their limitations: 1. Errors: AI generators make mistakes. Assume the output is incorrect unless you check the claims with reliable sources. 2. Bias: Their output may reflect bias because the data they are trained on may reflect bias or may not include sufficient data from certain groups. 3. Citation: These tools use existing sources without citation. Therefore, using their outputs puts you at risk of plagiarism. With these limitations in mind, you are welcome to use AI generators to brainstorm and refine ideas, find reliable sources, outline, check grammar, refine wording, and format bibliographies. Beyond bibliographies, you are not allowed to copy and paste material generated by AI and use it in your assignments. At the end of your bibliography, add a note indicating which AI tool you used and how you used it, including the prompt(s) you used and the date(s).

Copyright Issues

- Sharing copyrighted material with third-party AI tools is prohibited.
- While faculty and instructors do not own copyright to facts or ideas in their discipline, they do own copyright to their expression, explanation, and presentation of those facts and ideas in course notes, PowerPoint slides, etc. including assessments constructed for the course. As such, those instructor-generated materials should never be uploaded to any third-party site (whether AI-oriented or not).
- The potential consequences faced by students who are determined to have used AI tools in an unauthorized way will get a zero on that assessment and will be referred to the Office of Student Rights and Responsibilities.

Attendance Policy

This course follows the Academic Regulations: Attendance and Office of the Dean of Students: Class Absences posted in Brightspace under “University Policies and Statements.” The policies state that students are expected to be present for every meeting of the classes in which they are enrolled. Attendance will be taken at the beginning of each class and lateness will be noted.

When conflicts or absences can be anticipated, such as for many University-sponsored activities and religious observations, you should inform me of the situation as far in advance as possible. For unanticipated or emergency absences when advance notification is not possible, contact me as soon as possible by email or phone. For cases that fall under excused absence regulations, you or your representative should contact or go to the [Office of the Dean of Students \(ODOS\) website](#) to complete appropriate forms for instructor notification. Under academic regulations, excused absences may be granted by ODOS for cases of grief/bereavement, military service, jury duty, parenting leave, or emergent medical care.

Academic Guidance in the Event a Student Is Quarantined/Isolated

If you must miss a class at any point in time during the semester, please reach out to me via Purdue email so that we can communicate about how you can maintain your academic progress. For COVID-19 concerns, please see (see [Protect Purdue Updates for the Spring 2024 semester](#)). If you find yourself too sick to progress in the course, notify your adviser and notify me via email or Brightspace. We will make arrangements based on your particular situation.

Classroom Guidance Regarding Protect Purdue

Any student who has substantial reason to believe that another person is threatening the safety of others by not complying with Protect Purdue protocols is encouraged to report the behavior to and discuss the next steps with their instructor. Students also have the option of reporting the behavior to the [Office of the Student Rights and Responsibilities](#). See also [Purdue University Bill of Student Rights](#) and the Violent Behavior Policy under University Resources in Brightspace.

Academic Integrity

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information is submitted the greater the opportunity for the university to investigate the concern. More details are available on our course Brightspace under University Policies. *Under the Brightspace University Policies and Statements content is a hyperlink called “Purdue’s Student Guide for Academic Integrity” that links to the [Office of Student Rights and Responsibilities Academic Integrity webpage](#) and a link named “Use of Copyrighted Materials” that links to a [University Policy Office webpage](#).*

Nondiscrimination Statement

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Purdue University is committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. A hyperlink to Purdue's full Nondiscrimination Policy Statement is included in our course Brightspace under University Policies.

Accessibility

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247. More details are available on our course Brightspace under Accessibility Information.

Purdue also has assistance available to help you make learning materials accessible. Some examples include:

- *Information from Innovative Learning on [Universal Design for Learning](#)*
- *Guidance from Innovative Learning on [creating accessible documents](#)*
- *[Workshops on accessible materials](#) suggested by the DRC*
- *Contact innovativelearningteam@purdue.edu with questions.*

Basic Needs Security

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students 8 a.m.-5 p.m. Monday through Friday. Considering the significant disruptions caused by the current global crisis as it relates to COVID-19, students may submit requests for emergency assistance from the [Critical Need Fund](#)

Emergency Preparation

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

Bereavement

Purdue University recognizes that a time of grief is very difficult for a student. The University, therefore, provides the following rights to students facing the loss of a family member through the Grief Absence Policy for Students (GAPS):

<http://catalog.purdue.edu/content.php?catoid=6&navoid=2035>

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Purdue University Online Writing Lab (OWL): Provides *free* writing consultations and grammar assistance on assignments in Heavilon Hall 226 or visit <https://owl.english.purdue.edu/>.

Student Bill of Rights: The information herein is in accordance with the Purdue Student Bill of Rights, which may be located at

https://www.purdue.edu/studentregulations/student_conduct/studentrights.html

Course Materials: Some of the course material has been adapted from other department courses, and lab contributions have been provided by other Purdue students and modified for this course.

Cell Phone / Personal Device Use: It's understandable the use of personal electronic devices in certain important circumstances. However, **students must ask the instructor for permission to use their personal electronic devices such as cell phones, tablets, laptops, other smart devices, etc.** Otherwise, students will be asked to leave the classroom if any device is used for a purpose other than what is asked by the instructor.

Fraternizing Clause: The Instructor and teaching assistant(s) do not carry over any personal, professional, or business relationships into the classroom. Students will not be affected (positively or negatively) by any past, current, or future affiliation outside of the classroom, which includes but is not limited to, academic clubs, social clubs, employment, academic rank, professional organizations, and online groups. Any student who seeks to use outside affiliations in the classroom will be reminded of this policy, and outside consultation may occur with the department and/or the Office of the Dean of Students (ODOS) if needed.

The only exception is gaining participation credit by attending an available event (please see participation credit document); these opportunities are available to all students, regardless of their personal, professional, or business relationships and regardless of any identity (see above about inclusive environments). Events that require exclusive membership by a certain group or any other limiting identity may not be permitted.

Although your attendance in class is vital for you to be successful, the course instructor reserves the right to dismiss from class/lab any student who is not civil and respectful during class/lab.

Course Evaluation: During the last two weeks of the course, you will be provided with an opportunity to evaluate this course and your instructor. Purdue uses an online course evaluation system. You will receive an official e-mail from evaluation administrators with a link to the online evaluation site. You will have up to two weeks to complete this evaluation. Your participation is an integral part of this course, and your feedback is vital to improving education at Purdue University. It is strongly encouraged that you participate in the evaluation system.

Use of Copyrighted Materials:

1. All course materials are copyrighted by the instructor and may not be republished or posted for public viewing. Notes taken in class are considered derivative works and may not be republished or posted for public viewing.
2. Students are expected, within the context of the Regulations Governing Student Conduct and other applicable University policies, to act responsibly and ethically by applying the appropriate exception under the Copyright Act to the use of copyrighted works in their

activities and studies. The University does not assume legal responsibility for violations of copyright law by students who are not employees of the University.

3. Copyrightable Work created by any person subject to this policy primarily to express and preserve scholarship as evidence of academic advancement or academic accomplishment. Such works may include but are not limited to scholarly publications, journal articles, research bulletins, monographs, books, plays, poems, musical compositions and other works of artistic imagination, and works of students created in the course of their education, such as exams, projects, theses or dissertations, papers, and articles.

Academic Dishonesty (“Cheating”) Policies:

Student Honor Pledge - *“As a boilermaker is pursuing academic excellence; I pledge to be honest and true in all that I do. Accountable together - we are Purdue.”*

1. Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either e-mailing integrity@purdue.edu or by calling 765-494-8778. While the information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the University to investigate the concern.
2. Any form of cheating will result in a penalty up to an automatic “F” grade for the course. All instances of cheating will be forwarded to the Office of Student Rights and Responsibilities for appropriate disciplinary action.
3. Helping another student to cheat and cheating are considered equal cases of academic dishonesty and will be treated as outlined above.
4. Giving another student an electronic copy of your homework or access to your computer account constitutes cheating on your behalf if that other student copies or uses any files that become implicated in a cheating case.
5. Cheating via plagiarism is a particularly heinous form of academic dishonesty. Students are expected to know when and how to properly cite the published and unpublished intellectual property of other scholars. They are expected to understand that paraphrasing intellectual property is just as bad as directly copying or editing another’s work.

Plagiarism:

- Stealing or passing off the ideas or work of another as one’s own, and
- Paraphrasing or using someone else’s words or ideas without crediting the source.

Plagiarism is an act of fraud and academic misconduct. *Penalties for academic misconduct can range from a reprimand to a penalty as severe as a suspension for a definite time or even indefinite suspension.* For more information, please visit <http://www.plagiarism.org>

The instructor reserves the right to submit any and all research papers to Purdue’s plagiarism detection software service and act upon any negative results. Any form of plagiarism will result in a zero score for the assignment and a one-letter grade penalty for the course; the case may also result in an “F” grade for the course at the instructor’s discretion. The case will also be forwarded to appropriate university offices for disciplinary action, up to and including expulsion from the program and

University.

6. For a complete definition of academic dishonesty, see <http://www.purdue.edu/ODOS/osrr/integrity.htm>

Violent Behavior:

Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent behavior impedes such goals. Therefore, violent behavior is prohibited in or on any University facility or while participating in any university activity. See the Student Resource widget on our course Brightspace for more information on the Violent Behavior Policy.

Diversity, Inclusion & Belonging Statement

1. In our discussions, structured and unstructured, we will explore a variety of challenging issues, which can help us enhance our understanding of different experiences and perspectives. This can be challenging, but in overcoming these challenges we find the greatest rewards. While we will design guidelines as a group, everyone should remember the following points:
 - We are all in the process of learning about others and their experiences. Please speak with me, anonymously if needed, if you have concerns about aspects of/experiences in the course.
 - Intention and impact are not always aligned, and we should respect the impact something may have on someone even if it was not the speaker's intention.
 - We all come to the class with a variety of experiences and a range of expertise, we should respect these in others while critically examining them in ourselves.
2. This course, as with every course offered at Purdue, plays a part in creating and sustaining a welcoming campus where all students can excel. There are many initiatives at Purdue and supported by the university focused on this goal, and this course is designed to take advantage of those resources. Learning experiences and assignments address diversity and inclusion, not because they are "topics," but because they are necessary to prepare students to be successful in a diverse, global environment.
3. We strive for equity, providing equal access and opportunity, and working to maximize student potential. This requires both instructor and students to identify and remove barriers that may prevent someone from full access or full participation. You can help by:
 - Contacting me, anonymously if needed, if you see a potential barrier for someone or yourself in participating fully in the class. This might be a physical barrier such as access to technology or a personal situation.
 - Suggesting ways in which members of our class can support each other. Virtual study groups and discussion boards are examples, but I encourage you to be creative with your ideas.
 - Getting to know each other as contributing members of our learning community. Everyone has something to contribute, and while I designed the course to take

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advantage of the wealth of knowledge, expertise, and experience we bring together, I cannot do it well without your participation. There are many opportunities built into this course for this type of work. We must do it together.

Disabling Conditions:

1. Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at drc@purdue.edu or by phone: at 765-494-1247.
2. Any student who, because of a disabling condition, has accommodation from the Disability Resource Center must contact the instructor by the third week of class to make necessary accommodations. Students who do not contact the instructor by the third week of class, or as soon as they know they have a disabling condition should it occur during the semester, forfeit their rights to special accommodations.

Mental Health/ Wellness Statement

If you are beginning to feel some stress, anxiety and/or slightly overwhelmed, try [WellTrack](#). Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the [Office of the Dean of Students](#). Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc., sign up for free one-on-one virtual or in-person sessions with a [Purdue Wellness Coach at RecWell](#). Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign-up is free and can be done on BoilerConnect.

If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. Services are available if you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support. For help, such individuals should contact [Counseling and Psychological Services \(CAPS\)](#) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office on the second floor of the Purdue University Student Health Center (PUSH) during business hours. The [CAPS website](#) also offers resources specific to situations such as COVID-19.

Syllabus Change Policy

Except for changes that substantially affect the implementation of the evaluation statement, this syllabus is a guide for the course and is subject to change with advance notice.