

SYS 30000 It's a Complex World: Addressing Global Challenges - SPRING 21

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

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

CRN: 11228

Time: T, Th 3:00 pm - 4:15 pm

Location: WALC 1121

Instructional Modality: Face-to-Face

Course credit hours: 3 credit hours

Prerequisites: No prerequisites required.

This course uses Brightspace, if you do not have access, contact me.

Instructor: Dr. Tugba Karabiyik (Dr. K)

E-mail: tugba@purdue.edu

Phone: [765-496-5302](tel:765-496-5302)

Office: Grissom Hall, third floor (372)

Office Hours: 10:30 am – 11:30 am, T/Th online via zoom and by appointment.

Zoom link: <https://purdue-edu.zoom.us/j/65132389273>

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 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.

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

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 Objectives

1. Describe global challenges using engineering, biological, physical, and social scientific perspectives, including attention to the interdependence of the different perspectives.
2. Explain the fundamental concepts of ‘complex adaptive systems,’ including applications to different global challenges.
3. Develop basic proficiency in applying computer modeling to represent the behavior of complex systems, with applications to the global challenges.
4. 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.

Class Schedule

Week	Date	Topic
UNIT 1: Introduction to Systems		
1	Tu 1/19	Introduction to the class and syllabus
1	Th 1/21	Climate Change: A Systems Perspective
2	Tu 1/26	C-ROADS Simulation Set-up
2	Th 1/28	C-ROADS Simulation
3	Tu 2/2	Introduction to Systems
3	Th 2/4	Key Properties of Systems
4	Tu 2/9	Cybernetics
UNIT 2: Modeling and Simulation		
4	Th 2/11	Introduction to Modeling and Simulation
5	Tu 2/16	Agent-Based Models
5	Th 2/18	Introduction to Netlogo and Netlogo Tutorial
6	Tu 2/23	Top-Down Modeling
6	Th 2/25	Bottom-up Modeling
7	Tu 3/2	Final Discussion
UNIT 3: Networks		
7	Th 3/4	Networks Intro
8	Tu 3/9	Networks
8	Th 3/11	Networks
9	Tu 3/16	Networks Data Analysis
9	Th 3/18	Reading Day/ No Classes
10	Tu 3/23	Networks Data Analysis and Contagion
UNIT 4: Decision Making for Complex Systems		
10	Th 3/25	Introduction to Decision Making for Complex Systems
11	Tu 3/30	Final Project Status

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11	Th 4/1	Stakeholders and Framing Decision Opportunities
12	Tu 4/6	Multi-attribute Decision Making
12	Th 4/8	Introduction to System Modeling for Decision Making
13	Tu 4/13	Reading Day/ No Classes
UNIT 5: Game Theory		
13	Th 4/15	From Single Decision-Maker to Games
14	Tu 4/20	Fundamentals of Game Theory
14	Th 4/22	The Prisoner's Dilemma
15	Tu 4/27	Negotiation and Bargaining
15	Th 4/29	Simulation and Negotiations
Student Project Presentations		
16	5/1	Student project presentations (slides to be submitted)

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

Purdue [Academic Calendar](#) and key University dates for the Spring 2021 semester, such as:

Jan. 4 – Academic Year Faculty/Staff First Day

Jan. 19 – Classes Begin

Feb. 17 – Reading Day

March 18 – Reading Day

April 13 – Reading Day

May 1 – Classes End

May 3-8 – Final Exams

May 8 – Semester Ends

May 11 – Grades Due

Course Requirements

Each of the five main units of the course will include one (or more) assignments combined for a total of 60% of the final grade. There will also be a final project worth 40% of the final grade. A tentative schedule for the assignments is as follows:

Assignment	Type	Due Date	Weight	Group or Individual Score
Climate Simulation	Regular	28-Jan	5%	Group
Unit 1		23-Feb	7%	Individual
Final Project Proposal		4-Mar	5%	Group
Unit 2		9-Mar	12%	Individual
Unit 3		1-Apr	12%	Individual
Unit 4		15-Apr	12%	Group
Unit 5		20-Apr	12%	Group
Final Project Slides		27-Apr	5%	Group
Final Project Report		30-Apr	25%	Group
Final Project Peer Review		30-Apr	5%	Individual
Total Regular Assignments			100%	

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Assignment	Type	Due Date	Weight	Group or Individual Score
Course Evaluation	Extra Credit	9-May	1%	Individual
Total with Extra Credit			101%	

Missed or Late Work

1. Work is due at the start of class on the due date, unless otherwise indicated. Late work is not acceptable. **If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try [WellTrack](#).** Sign in and find information and tools at your fingertips, available to you at any time.
2. **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.
3. **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 completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.
4. **If you're struggling and need mental health services:** Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. 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 of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Required Texts

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

Required software

- 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

Grading

Final grades will be assigned as follows:

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

Attendance Policy during COVID-19

Students are expected to attend all classes in-person unless they are ill or otherwise unable to attend class. If they feel ill, have any symptoms associated with COVID-19, or suspect they have been exposed to the virus, students should stay home and contact the Protect Purdue Health Center (496-INFO).

In the current context of COVID-19, in-person attendance cannot be a factor in the final grades. However, timely completion of alternative assessments can certainly be part of the final grade. Students need to inform the instructor of any conflict that can be anticipated and will affect the timely submission of an assignment or the ability to take an exam.

Classroom engagement is extremely important and associated with your overall success in the course. The importance and value of course engagement and ways in which you can engage with the course content even if you are in quarantine or isolation, will be discussed at the beginning of the semester. Student survey data from Fall 2020 emphasized students' views of in-person course opportunities as critical to their learning, engagement with faculty/TAs, and ability to interact with peers.

Only the instructor can excuse a student from a course requirement or responsibility.

When conflicts can be anticipated, such as for many University-sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency conflicts, when advance notification to an instructor is not possible, the student should contact the instructor/instructional team as soon as possible by email, through Brightspace, or by phone. In cases of bereavement, quarantine, or isolation, the student or the student's representative should contact the Office of the Dean of Students via email or phone at 765-494-1747. Our course Brightspace includes a link to the Dean of Students under 'Campus Resources.'

Academic Guidance in the Event a Student is Quarantined/Isolated

If you must quarantine or isolate at any point in time during the semester, please reach out to me via email so that we can communicate about how you can continue to learn remotely. Work with the Protect Purdue Health Center (PPHC) to get documentation and support, including access to an Academic Case Manager who can provide you with general guidelines/resources around communicating with your instructors, be available for academic support, and offer suggestions for how to be successful when learning remotely. Your Academic Case Manager can be reached at acmq@purdue.edu. Importantly, if you find yourself too sick to progress in the course, notify your academic case manager and notify me via email or Brightspace. We will make arrangements based on your particular situation.

Classroom Guidance Regarding Protect Purdue

The [Protect Purdue Plan](#), which includes the [Protect Purdue Pledge](#), is campus policy and as such all members of the Purdue community must comply with the required health and safety guidelines. Required behaviors in this class include: staying home and contacting the Protect Purdue Health Center (496-INFO) if you feel ill or know you have been exposed to the virus, properly wearing a mask [in classrooms and campus building](#), at all times (e.g., mask covers nose and mouth, no eating/drinking in the classroom), disinfecting desk/workspace prior to and after use, maintaining appropriate social distancing with peers and instructors (including when entering/exiting classrooms), refraining from moving furniture, avoiding shared use of personal items, maintaining robust hygiene (e.g., handwashing, disposal of tissues) prior to, during and after class, and following all safety directions from the instructor.



Students who are not engaging in these behaviors (e.g., wearing a mask) will be offered the opportunity to comply. If non-compliance continues, possible results include instructors asking the student to leave class and instructors dismissing the whole class. Students who do not comply with the required health behaviors are violating the University Code of Conduct and will be reported to the Dean of Students Office with sanctions ranging from educational requirements to dismissal from the university.

Any student who has substantial reason to believe that another person in a campus room (e.g., classroom) is threatening the safety of others by not complying (e.g., not wearing a mask) may leave the room without consequence. The student is encouraged to report the behavior to and discuss 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](#).

Related Considerations:

- A listing of recommended safe practices for the specific class or laboratory setting (other PPE or safety behavior) can be found at the links below.*
 - [Overarching SOP for Classrooms, Instructional Laboratories, and Experiential Courses](#)
- References Supporting Protect Purdue Compliance:*
 - Office of the Dean of Students [Protect Purdue Compliance Plan: Ask, Offer, Leave, Report](#)
 - Office of the Dean of Students [Managing Classroom Behavior and Expectations](#)

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.*

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>

Class Policies:

Late Policy: By default, **all late submissions will be graded 0 points**. To receive full credit on a late assignment, the student must arrange late submission before the due date with the Instructor. Students who miss the deadline should speak to the Instructor if they believe they should receive partial credit and may have to submit additional work.

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.

Non-Discrimination Policies: Purdue University is committed to maintaining a community which 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 own 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. More details are available on our course Brightspace table of contents, under University Policies.

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 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. A 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 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>

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: 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:

5. **If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try [WellTrack](#).** Sign in and find information and tools at your fingertips, available to you at any time.
6. **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.
7. **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 completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

8. **If you're struggling and need mental health services:** Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. 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 of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Violent Behavior:

1. 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.
2. See the University's full policy for more detail:
<https://www.purdue.edu/policies/facilities-safety/iva3.html>

Class Readings & Assignments:

You are expected to have the assigned readings (as listed in your Class Schedule) completed 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 of 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 course work 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 an office hour 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 School of Industrial Engineering or the Chair of the College of Engineering Grade Appeals Committee.

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.

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 (at least three times, morning-noon-evening, a day).

Related Considerations and Guidelines

1. *If you experience any symptoms of COVID-19 or suspect you may have been exposed to someone with COVID-19 stay home and call the Protect Purdue Health Center at 765-496-INFO.*
2. *Keep your cell phone on to receive a Purdue ALERT text message.*
3. *Log into a Purdue computer connected to the network to receive any Desktop Popup Alerts.*

If you have completely read this syllabus, e-mail three underlined, italicized, and bold (e.g., **all together**) keywords/key phrases you found in the syllabus to Dr. K and ask for one extra credit towards your final grade. Make sure not to share this information with other students in the class. The request must be made before the second-class meeting on Thursday, January 21th, 2021.

Syllabus Change Policy: Except for changes that substantially affect the implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.