

Models and Methods for Health Systems Engineering

EIN 5501 (Section 3910) and EIN 4905 (Section 3250)

Class Periods/Location:

T, Period 7 (1:55 - 2:45 PM) / WEIM 1076
R, Period 7/8 (1:55 - 3:50 PM) / WEIM 1076

Academic Term: Spring 2023

Instructor:

Dr. Karen T. Hicklin

Assistant Professor

Department of Industrial and Systems Engineering

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Office Hours (via Zoom):

Tuesdays: 3-4pm

Wednesdays: 2-3pm

Course Description

Introduction to the application of systems engineering and data analytics methods to healthcare systems. Exploration of common problems of decision-making and optimization in healthcare including scheduling and capacity planning. Examination of health policy, data analysis, and information technology unique to healthcare. Investigation of lean and six sigma to continuous improvement.

Course Pre-Requisites / Co-Requisites

COP 2271 Computer Programming for Engineers, STA 4322 Introduction to Statistics Theory, ESI 4523 Industrial Systems Simulation and *ESI 4312* Operations Research 1 and *ESI 4313* Operations Research 2 with minimum grades of C.

Course Objectives

This 3-credit course intends to introduce the basic techniques for the modeling, simulation, analysis and optimization of healthcare delivery systems. By the end of this course, students will have gained experience in the following aspects:

- Analyze the context and components of the health care delivery systems and the roles of industrial engineers
- Evaluate the use of key industrial engineering and operations research concepts in health care delivery
- Solve selected health care delivery problems using industrial engineering and operations research methodology
- Evaluate key measures used to assess health care system performance

Major Outcomes:

- **Knowing:** common terminology, concepts, and practices in various healthcare delivery environments; commonly recognized problems with healthcare delivery systems; various key measures used to assess healthcare system performances; why sustaining and spreading healthcare system performance and practices are difficult, what may be done to improve.
- **Doing:** using basic industrial engineering tools to solve system performance evaluation and decision-making questions in healthcare delivery systems.

Materials and Supply Fees

None

Required Textbooks and Software

- **Laptop:** You must have a laptop to be enrolled in this course. The laptop is needed to access software and to complete in-class activities, homework assignments, case studies, and term project.

- **Software:** For the class you will require access to several Software, including R, Simio, Microsoft Excel, CPLEX, GUROBI, etc.
- **Course Textbook:** Griffin, Paul M., Harriet B. Nembhard, Christopher J. DeFlicht, Nathaniel D. Bastian, Hyojung Kang, and David A. Munoz. *Healthcare systems engineering*. John Wiley & Sons, 2016; ISBN-13: 978-1118971086; ISBN-10: 1118971086
- **Additional Readings:** Additional reading will be provided on class website (UF e-learning) and students are responsible for checking the web page to download the required documents.

Recommended Materials

- Vissers, J., & Beech, R. (2005). *Health operations management: patient flow logistics in health care*. Psychology Press.
- Reid, P. P., Compton, W. D., Grossman, J. H., and Fanjiang, G. Editors, (2005). *Building a Better Delivery System: A New Engineering/Health Care Partnership*. Institute of Medicine, National Academy of Sciences (Available from www.iom.org)
- Denton, B. T. (2013). *Handbook of healthcare operations management: Methods and Applications*. New York: Springer.

Course Schedule*

Week	Dates	Topics	Remarks
1	January 10	Module 1: Health Care Delivery System Overview	
	January 12	Module 1: Health Care Delivery System Overview	
2	January 17	Module 1: Health Care Delivery System Overview	HW 1
	January 19	Module 2: Complexity and Systems in Healthcare	
3	January 24	Module 2: Complexity and Systems in Healthcare	ICA 1
	January 26	Module 2: Complexity and Systems in Healthcare	
4	January 31	Module 3: Patient Flow, Simulation, and Queuing	HW 2
	February 2	Module 3: Patient Flow, Simulation, and Queuing	
5	February 7	Module 3: Patient Flow, Simulation, and Queuing	Project Introduction
	February 9	Module 4: Healthcare Logistics and Supply Chains	Case 1 Introduction
6	February 14	Module 4: Healthcare Logistics and Supply Chains	
	February 16	Module 4: Healthcare Logistics and Supply Chains	HW 4
7	February 21	Module 5: Healthcare Finance	
	February 23	Module 5: Healthcare Finance	
8	February 28	Module 6: Health Data and Informatics	
	March 2	Module 6: Health Data and Informatics	Case 2 Introduction
9	March 7	Module 7: Lean/Six Sigma	
	March 9	Module 7: Lean/Six Sigma	ICA 3 & Project Update 1 due
10	March 14	NO CLASS - SPRING BREAK	
	March 16	NO CLASS - SPRING BREAK	
11	March 21	Module 8: Patient safety, human factors/ergonomics	
	March 23	Module 8: Patient safety, human factors/ergonomics Module 9: Health Analytics	
12	March 28	Module 9: Health Analytics	HW 5
	March 30	Module 10: Medical Decision Making, Cost-effectiveness Modeling	Case 3 Introduction
13	April 4	Module 10: Medical Decision Making, Cost-effectiveness Modeling	Project Update 2 due

	April 6	Module 10: Medical Decision Making, Cost-effectiveness Modeling	
14	April 11	Module 11: Infection Control	
	April 13	Module 11: Infection Control	
15	April 18	Module 11: Infection Control	HW 6
	April 20	Project Work Day	
16	April 25	Final Project Presentations	Project Presentation Due
FINAL	May 5	Final Exam Period: 10 AM - 12 PM (reserved if needed)	Project Report Due

*This course schedule is tentative and subject to change as the semester progresses.

Assignments

Homework, Quizzes, and Class Assignments

There will be 8-10 homework, quizzes, and/or class assignments throughout the semester. Material will be drawn from the course textbook or assigned readings from healthcare systems engineering and health service research. Homework is an individual assignment performed outside of class time where due dates are announced in advance. Quizzes and class assignments may be given through Canvas following the announcement on the day of class.

Case studies

There will be 3 case study assignments made during the course. Teams of 2-3 students will be selected to lead the discussion of one article and present its major content/findings to the class (suggested structure: background, problem and/or research question(s), methodology, analysis, findings, implications of findings, your insights/takeaways, and strengths/weaknesses of the study). The articles should be read critically. In that regard, each team should also present a list of three questions or issues that surfaced while reading the article which can be used as a starting point for a general class-wide discussion.

Term project

There will be one term project for the semester. The term project is to investigate one healthcare systems engineering related topic. The course instructor will identify a topic. The team will present findings from the chosen case study about a healthcare organization, healthcare unit, or patient level that used industrial engineering methods, tools, and techniques. Students will work in teams of 3-4 students and the outcome of their findings will be documented in a written report and will also be presented at the end of the course. Effort report and peer evaluations will be required.

Online Course Recording

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Attendance Policy, and Make-Up Policy

Attendance is required. Excused absences must be consistent with university policies in the Undergraduate Catalog and require appropriate documentation (<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>).

- University and Departmental guidelines will be applied to categorize excused and unexcused absences. Students unable to attend class should notify the instructor of excused absences via email IN ADVANCE of the planned absence; in emergency situations the notification should occur BEFORE THE NEXT SCHEDULED LECTURE.
- Regardless of whether an absence is excused or unexcused, students are responsible for any coursework missed because of the absence. Students are expected to be aware of all announcements made in class and know all previously covered material when attending the following class.

Late Assignments and Make-Up Policy

Late assignments will be accepted for 24 hours after the due date with a 25% deduction.

In general, there will be no makeup assignments given. However, a student is permitted to make up a missed assignment without penalty if he/she has a conflict between the assignment and a scheduled University-approved activity. A student needing a make-up assignment due to schedule conflicts must notify the instructor at least one week before the day the exam or assignment is scheduled. Excused absences are consistent with university policies and require appropriate documentation.

Evaluation of Grades:

Assignment	Percentage of Final Grade
Homework, Quizzes, Class Assignments	50%
Case Studies	25%
Final Project	25%
Total	100%

Grading Policy

Percent	Grade	Grade Points
93.0 – 100	A	4.00
90.0 – 92.9	A-	3.67
87.0 – 89.9	B+	3.33
83.0 – 86.9	B	3.00
80.0 – 82.9	B-	2.67
77.0 – 79.9	C+	2.33
73.0 – 76.9	C	2.00
70.0 – 72.9	C-	1.67
67.0 – 69.9	D+	1.33
63.0 – 66.9	D	1.00
60.0 – 62.9	D-	0.67

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.ua.ufl.edu/students/>. Students will be notified when the

evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.