ISYE 3232 STOCHASTIC MANUFACTURING AND SERVICE SYSTEMS

Credit: 3-0-3

Required

Prepared Prof. Ayhan, Foley, Kim, Maguluri, Tovey, Summer 2018

Prerequisite(s): ISYE 2027

Catalog Description:
Models for describing stochastic movements of parts and materials in manufacturing facilities, supply chains, and inventory systems. Analysis of congestion, delays, machine usage, line balancing, equipment availability, inventory ordering policies, and system crashes. Basics of Markov Chains and queueing theory.

Texts:
Goldratt, E, *The Goal: Process On Ongoing Improvement*, North River, 3rd Ed., 2003.

Feldman, R.M., and Valdez-Flores, C., *Applied Probability and Stochastic Processes* (custom printing), Thomson, 2004.

Littlefield Technology Access Case, Responsive L, 2007.

Objective
The objective of this course is to develop stochastic modeling techniques and managerial insights for design and control or manufacturing and service systems.

Topical Outline

Topics	Weeks
Discrete and Continuous-Time Markov Chains: Markov Property, Transition Probabilities, State Classifications, Exponential Distribution, Poisson Process.	8
Queueing Processes: Basic Definitions, Single Server Systems, Multiple Server Systems, Jackson Networks, Approximations	3
Production Models: Serial Production Systems, Selecting Distributions, Bottleneck/Throughput Analysis, Line Balancing.	2
Stochastic Models: Basic Inventory Models Including Newsvendor and Single Period.	2

Outcomes

At the end of this course, students will be able to:

1. Model a system when randomness is significant
2. Describe how variability affects a system's behavior and performance
3. Apply Markov Chains
4. Apply basic inventory models
5. Define key concepts in production flow such as bottlenecks, line balancing, and Little's Law
6. Use open and closed Jackson networks
7. Maintain throughput in a closed Jackson network and compute corresponding WIP levels

Course outcome \ Program Outcomes	1. identify, formulate solve engg prob by engg, sci & Math	2. produce solutions consider public health, safety, welfare, global, cultural, social, environ & economic	3 communicate with a range of audience	4 recognize ethical & professional responsibilities, make informed judgement consider resolutions in global, economic, environ and societal context.	5. effective on a team provide leadership, collaborative and inclusive envirn, plan tasks & meet objectives	6. develop and conduct experiment, analyze and interpret data & use engineering judgement to draw conclusions.	7. acquire and apply new knowledge using appropriate learning strategies
1. Model a system when randomness is significant.	H						
2. Describe how variability affects a system's behavior and performance.	H						
3. Apply Markov Chains	H						
4. Apply basic inventory models	H						
5. Define key concepts in production flow such as bottlenecks, line balancing and Little's Law	H						
6. Use open and closed Jackson networks							
7. Maintain throughput in a closed Jackson network and compute WIP levels							

Evaluation of the important outcomes
The outcomes 1, 2, 3, 4 and 5 will be assessed via direct questions on final exam.

Comparison of old ABET Student Outcomes a – k to new 1 – 7

OLD Criterion 3. Student Outcomes The program must have documented student outcomes that prepare graduates to attain the program educational objectives. Student outcomes are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.	NEW Criterion 3: Student Outcomes The program must have documented student outcomes that support the program educational objectives. Attainment of these outcomes prepares graduates to enter the professional practice of engineering. Student outcomes are outcomes (1) through (7), plus any additional outcomes that may be articulated by the program.
(a) an ability to apply knowledge of mathematics, science, & engineering (e) an ability to identify, formulate, and solve engineering problems	(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health & safety, manufacturable, & sustainable	(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
(g) An ability to communicate effectively.	(3) An ability to communicate effectively with a range of audiences.
(f) an understanding of professional and ethical responsibility (h) the broad education necessary to understand the impact of engg solutions in a global, economic, environmental, & societal context (j) a knowledge of contemporary issues	(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
(d) an ability to function on multidisciplinary teams	(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative & inclusive environment, establish goals, plan tasks, and meet objectives.
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
(i) a recognition of the need for, and an ability to engage in life-long learning	(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	Implied in 1, 2 and 6