DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING

ISEN 316: PRODUCTION SYSTEMS OPERATIONS

REQUIRED or ELECTIVE: Required Course

CATALOG DESCRIPTION (3-0) Credit 3

Analytical principles of manufacturing systems design, analysis and control; emphasis placed on stochastic analysis; role of variability and impact on cycle time; push versus pull production strategies including Kanban and constant WIP control; probability, queuing theory, Little's Law, heavy traffic approximations, and queuing networks.

PREREQUISITES

ISEN 220, ISEN 424, MATH 304

PROFESSIONAL COMPONENT

This course provides fundamental concepts and theory for the treatment of the principles, models, and techniques for the planning, analysis, design, and operation of production systems. Course topics include inventory management, variability reduction, cycle time reduction, and lead-time stabilization with an emphasis on analytical modeling approaches. These approaches and methods emphasize the decision-making process in operational planning, analysis, design and control of production systems. The course is aimed at developing a better understanding of production operations, by providing foundations for mathematical modeling/ analysis methods needed to solve these problems.

COURSE LEARNING OUTCOMES

At the end of the course, students should be able to

- learn formulations, models, and analytical procedures for the study of production operations problems;
- learn fundamental principles of production systems,
- be able to develop queueing approximation models for capacity, production, and inventory decisions; and
- improve systems thinking and modeling skills.

TEXTBOOK

Manufacturing Systems Modeling and Analysis; G. L. Curry and R.M. Feldman, Springer, ISBN: 978-3-540-88762-1.

TOPICS COVERED

1. Introduction
2. Production System Elements and Modeling Paradigm: Throughput, WIP and Cycle Time
3. Probability
    a. Probability Spaces: outcome space, probability measures, and events
    b. Random Variables and Distribution Functions
    c. Conditional Probability: rules for computing variances and coefficients of variation

4. Long Run Average Characteristics: Little's Law
5. Modeling WIP and Cycle Time
6. Role of Variability:
   a. Diffusion approximations for single workstations
   b. Obtaining hidden workstation capacity
7. Factory as a Network of Queues:
   a. Open queueing networks approximations
   b. Batch processing
   c. Multiple product classes
8. WIP Limiting Control:
   a. CONWIP and closed queueing networks approximations
   b. Kanban control and associated models

CLASS AND LAB SCHEDULE

One hundred and fifty minutes of lectures per week; either three days a week at 50 minutes per day or two days a week at 75 minutes per day. No laboratory component.

CONTRIBUTION TO MEETING REQUIREMENTS OF CRITERION 5:

Subject	Semester hrs	Subject	Semester hrs	Subject	Semester hrs
Mathematics		Engineering Science	2	General	
Basic Science		Engineering Design	1		

RELATIONSHIP OF COURSE TO PROGRAM OUTCOMES:

A. Ability to apply knowledge of mathematics, science and engineering
E. Ability to identify, formulate and solve engineering problems
K. Ability to use the techniques, skills and modern engineering tools necessary for engineering practice

PREPARED BY: Martin A. Wortman **Date** February 16, 2010