ENG ME 510 Production Systems Analysis

2008-2009 Catalog Data:
ENG ME 510 Production Systems Analysis Prereq: ENG ME 345 consent of instructor; grad prereq: consent of instructor. Operations research and dynamic systems methods applied in modeling, analysis, and control of production systems. Inventory analysis and control for single and multi-item systems based on deterministic and stochastic demand models. Machine, flow shop and job shop scheduling, project scheduling with PERT and CPM. Production control methods: MRP, MRP-II, Just-in-Time, and Kanban. 4 cr.

Class/Lab Schedule: 4 lecture hours/week

Status in the Curriculum: Elective, Systems Elective in Manufacturing Program

Textbook(s) and/or Other Required Material: Steven Nahmias, *Production & Operations Analysis*} 6th Ed. McGraw-Hill, 2009.

References: Sipper and Bulfin, Jr., *Production: Planning, Control, and Integration*, McGraw-Hill, 1997.
Fogarty, Blackstone, and Hoffman, *Production & InventoryManagement*, 2nd Ed., South Western, 1991.
Hax and Candea, *Production and Inventory Management*, Prentice-Hall, 1984.
Vollman, Berry, and Whybark, *Manufacturing Planning and Control Systems*, Richard D. Irwin, Inc., 1984.
Baker, *Introduction to Sequencing and Scheduling*, Wiley, 1974.
French, *Sequencing and Scheduling*, Wiley, 1982.

Coordinator: James R. Perkins, Associate Professor, Mechanical Engineering

Goals:
This senior/graduate student mezzanine-level course provides an overview of methods and models used in the analysis and synthesis of production systems. As a Systems Elective, it is intended to provide depth in the area of manufacturing systems, building on the material in ME 308 (Statistics and Quality Engineering). The ten course assignments cover an array of topics, providing students with a solid foundation in production systems analysis.

Prerequisites by topic:
1. A thorough understanding of single and multiple variable calculus, as taught in the MA 123, MA 124, MA 225 sequence.
2. A rudimentary knowledge of the use of random variables, as taught in ME 308, is highly recommended.

Course Learning Outcomes:

As outcomes of completing this course, students will:

i. Gain an increased proficiency in the analysis, synthesis, and control of manufacturing systems;
ii. Develop the ability to identify, and quantify in mathematical models, the tradeoffs between conflicting objectives;
iii. Learn how to implement hierarchical and modular decomposition approaches to problem-solving in manufacturing systems;
iv. Gain an understanding of practical operational issues facing manufacturing systems engineers;
v. Develop an enhanced capability to use elementary models and methods to obtain significant results for more complex systems.

Course Learning Outcomes mapped to Program Outcomes:

Program:	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Course:	i, iv, v	i, iv	ii, iii, v		i, ii, iii, iv, v				iv		i, iii, iv,v			
Emphasis:	5	3	3	1	5	1	1	1	4	1	5	1	1	1

Topics:

1. Deterministic and stochastic inventory models: Economic Order Quantity (EOQ), Economic Lot-Sizing Problem (ELSP), Dynamic lot-size models, (s,Q), (s,S), and other stochastic models
2. Demand forecasting: average, moving average, exponential smoothing, other methods
3. Aggregate Production Planning (PP) and Master Production Scheduling (MPS): LP models
4. Material Requirements Planning (MRP) and production control methods: MRP and MRP-II, Just-in-Time (JIT), Kanban, and flow control
5. Supply chain management: Enterprise Resource Planning (ERP), inventory balancing
6. Analysis of throughput, production lead time, and Work-in-Process (WIP): Kingman's equation, CONWIP, mean value analysis
7. Scheduling: classical scheduling theory (single/multiple machines, flow shops, and job shops); neoclassical scheduling theory (scheduling of human resources); project scheduling (PERT/CPM)

Contribution of Course to Meeting the Professional Component:
Engineering topics: 75% Math: 25%

Status of Continuous Improvement Review of this Course:
Prepared by: Professor James R. Perkins Date: 4/10/09