LSC Use Only No:	LSC Action-Date:	UWUCC USE Only No.	UWUCC Action-Date:	Senate Action Date:
		03-136	Appr 4/6/04	Appr 12/7/04

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

Contact Person	Email Address
Gary Stoudt	gsstoudt@iup.edu
Proposing Department/Unit	**Phone**
Mathematics	7-2608

Check all appropriate lines and complete information as requested. Use a separate cover sheet for each course proposal and for each program proposal.

1. Course Proposals (check all that apply)

_____New Course _____Course Prefix Change _____Course Deletion

__X__Course Revision _____Course Number and/or Title Change __X__Catalog Description Change

MATH 446 Probabilistic Models in Operations Research	MATH 446 Probabilistic Models in Operations Research
***Current* Course prefix, number and full title**	***Proposed* course prefix, number and full title, if changing**

2. Additional Course Designations: check if appropriate

_____ This course is also proposed as a Liberal Studies Course. _____ Other: (e.g., Women's Studies, Pan-African)

_____ This course is also proposed as an Honors College Course.

3. Program Proposals

_____Catalog Description Change _____Program Revision

_____New Degree Program _____Program Title Change _____Other

_____New Minor Program _____New Track

***Current* program name**	***Proposed* program name, if changing**

4. Approvals		**Date**
Department Curriculum Committee Chair(s)	George E. Mitchell	11-24-03
		/
Department Chair(s)	Gary Stoudt	11-24-03
College Curriculum Committee Chair		03/18/04
College Dean		3/18/04
Director of Liberal Studies *		
Director of Honors College *		
Provost *		
Additional signatures as appropriate:		
(include title)		
UWUCC Co-Chairs	Gail S Sechrist	4-6-04

* where applicable

I. Catalog Description

MATH 446 Probabilistic Models in Operations Research — 3 class hours, 0 lab hours, 3 credits (3c-0l-3cr)

Prerequisites: MATH 122 or 124; MATH 171; MATH 216

A survey of probabilistic methods for solving decision problems under uncertainty. Probability review, decision theory, queuing theory, inventory models, and Markov chains are covered. Students will use technology to solve problems and interpret the results.

II. Course Objectives

Students will be able to:

1. Formulate a mathematical model of a problem, solve the mathematical model, verify the model, and present the results of the analysis.
2. Use appropriate computer software to solve the problems of operations research.
3. Understand inventory models.
4. Apply waiting line and queuing theory.
5. Make decisions where two groups have conflicting interests.

III. Course Outline

A. Review of Probability — 3 hours
   1. Rules of Probability
   2. Random Variables and Probability Distributions
   3. Mean, Variance, Covariance

B. Decision Theory — 6 hours
   1. Decision Criteria
   2. Utility Theory
   3. Decision Trees
   4. Bayes' Rule

C. Game Theory — 8 hours
   1. Two-Person Zero-Sum Games
   2. Two-Person Constant-Sum Games
   3. *n*-person Game Theory

D. Deterministic Inventory Problems — 3 hours
   1. Economic Order Quantity (EOQ) Model
   2. Quantity Discounts
   3. Continuous rate EOQ Model
   4. Back Orders

E. Probabilistic Inventory Models — 6 hours
   1. Single Period Decision Models
   2. Marginal Analysis
   3. News Vendor Problems

F. Queuing Theory — 6 hours
   1. Modeling Arrival and Service Processes
   2. Birth-Death Processes
   3. Steady State Probability Distributions for Queuing Systems

This syllabus leaves 4 hours for tests and 6 hours for presentation of student projects.

Final Exam—During Final Exam Week.

IV. Evaluation Methods

Grades will be based on homework assignments, projects, tests, and a comprehensive final examination.

The final grade will be determined as follows:

Homework assignments	20%
Tests	40%
Oral and Written Project	20%
Final Exam	20%

Grading Scale: A: 90-100%; B: 80-89%; C: 70-79%; D: 60-69%; F: below 60%

V. Attendance Policy:

The instructor will provide an attendance policy consistent with University policy.

VI. Required Textbook(s), Supplemental Books and Readings

Winston, Wayne L. (2004) *Operations Research - Applications and Algorithms*, 4th ed. Belmont, CA: Duxbury Press.

VII. Special Resources or Requirements

None.

VIII. Bibliography

Bazaraa, Mokhtar S., John J. Jarvis, and Hanif D. Shera (1990). *Linear Programming and Network Flows*. New York: John Wiley and Sons.

Dantzig, George B. (1998). *Linear Programming and Extensions*. Princeton, NJ: Princeton University Press.

Fudenberg, Drew and Jean Tirole. (1991). *Game Theory*. Cambridge, MA: MIT Press.

Hoel P. G., S. C. Port, and C. J. Stone. (1987). *Introduction to Stochastic Processes*. Prospect Heights, IL: Waveland Press.

Hillier Frederick. S. and Gerald J. Lieberman. (2002). *Introduction to Operations Research.* New York: McGraw Hill.

Hillier Frederick. S. and Gerald J. Lieberman. (1990). *Introduction to Stochastic Models in Operations Research.* New York: McGraw Hill.

Murty, Katta. (1983). *Linear and Combinatorial Programming*. New York: John Wiley and Sons.

Osborne, Martin and Ariel Rubinstein. (1994). *A Course in Game Theory*. Cambridge, MA: MIT Press.

Taha, Hamdy (2002). *Operations Research: An Introduction.* Upper Saddle River, NJ: Prentice Hall.

Wright, Margaret and Philip E. Gill. (1982). *Practical Optimization*. Burlington MA: Academic Press.

2. Summary of Proposed Revisions

We are changing the prerequisite and the course description. The old prerequisite is "Two-semester sequence of calculus, MATH 363." We are changing this to MATH 171 and MATH 216 and MATH 122 or MATH 124.

3. Justification for the Revision

MATH 122 or MATH 124 are the terminal courses in the two semester sequence of calculus at IUP, so this change formalizes the calculus prerequisite. The knowledge of probability gained in MATH 216 rather than MATH 363 is sufficient for the course. MATH 171 is an introductory course in linear algebra (matrices, etc.) Matrix techniques are essential in solving the problems studied in the course.

We are changing the course description to emphasize the mathematics behind the techniques of the course. This course has always emphasized the mathematics, we are just making it explicit.

4. Old Syllabus of Record
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Mathematics Department
Indiana University of Pennsylvania
Indiana, PA 15705

Course Number: MA 446/546

Course Title: Probabilistic Models in Operations Research

Credits: 3 semester hours

Prerequisites: Calculus sequence and completion of a course in Probability and Statistics

Textbook: An Introduction Operations Research by Taha 4th edition

Revised: September 1989

Catalog Description:

Development of probabilistic models for managerial and social sciences, relevant algorithms and their solution using computer packages.

Course Outline/Time Schedule:

I. Review of Probability
   - A. Laws of probability
   - B. Random variables and Probability distributions
   - C. Central Limit Theorem
   - D. Stochastic Processes
   - E. Markov Chains

II. Decision Theory
   - A. Decision Under Risk
   - B. Decision Trees
   - C. Decisions Under Uncertainty

III. Project Scheduling
   - A. CPM
   - B. PERT
   - C. Probability and cost consideration models

IV. Inventory Models
   - A. Deterministic Models
   - B. Probabilistic Models

V. Markovian Decision Models
   A. Finite-Stage Dynamic Programming Model
   B. Infinite-Stage Model

VI. Queueing Models
   A. Formulation of the Queuing Model
   B. Roles of the Poisson and Exponential Distributions
   C. Queues with Convined Arrivals and Departures
   D. Queues with Priorities for Service
   E. Tandem or Series Queues

VII. Simulation
   A. Scope of simulation applications
   B. Discrete simulation approaches
   C. Random number generation and testing
   D. Introduction to SLAM

VIII. Student Projects
   A. Student presentations of projects completed during the semester