New Course Request **Indiana University** South Bend Campus

Check Appropriate Boxes: Undergraduate credit ☐ Graduate credit ☒ Professional credit ☐

1. School/Division Liberal Arts and Sciences 2. Academic Subject Code MATH
3. Course Number M575 (must be cleared with University Enrollment Services) 4. Instructor M. Shafii-Mousavi
5. Course Title Simulation Modeling

   Recommended Abbreviation (Optional) _____
   (Limited to 32 Characters including spaces)
6. First time this course is to be offered (Semester/Year): Spring 2003
7. Credit Hours: Fixed at 3 or Variable from _____ to _____
8. Is this course to be graded S-F (only)? Yes ____ No X
9. Is variable title approval being requested? Yes ____ No X
10. Course description (not to exceed 50 words) for Bulletin publication: P: M216; M365, M360 or C455; C101 The statistics needed to analyze simulated data; examples such as multiple server queuing methods, inventory control, and exercising stock options; variance reduction variables and their relation to regression analysis. Monte Carlo method, Markov chain, and the alias method for generating discrete random variables.
11. Lecture Contact Hours: Fixed at 3 or Variable from _____ to _____
12. Non-Lecture Contact Hours: Fixed at _____ or Variable from _____ to _____
13. Estimated enrollment: 20 of which 75 percent are expected to be graduate students.
14. Frequency of scheduling: Every other year Will this course be required for majors? Yes
15. Justification for new course: Required for new MS in Applied Mathematics and Computer Science degree.
16. Are the necessary reading materials currently available in the appropriate library? Yes
17. Please append a complete outline of the proposed course, and indicate instructor (if known), textbooks, and other materials.
18. If this course overlaps with existing courses, please explain with which courses it overlaps and whether this overlap is necessary, desirable, or unimportant. N/A
19. A copy of every new course proposal must be submitted to departments, schools, or divisions in which there may be overlap of the new course with existing courses or areas of strong concern, with instructions that they send comments directly to the originating Curriculum Committee. Please append a list of departments, schools, or divisions thus consulted.

Submitted by:

_____ Date 3-18-02
Department Chairman/Division Director

_____ Date _____
Dean of Graduate School (when required)

Approved by:

Lynn Williams for MJS Date 5/13/02
Dean

_____ Date _____
Chancellor/Vice-President

_____ Date _____
University Enrollment Services

After School/Division approval, forward the last copy (without attachments) to University Enrollment Services for initial processing, and the remaining four copies and attachments to the Campus Chancellor or Vice-President.

UPS 724

University Enrollment Services Final—White; Chancellor/Vice-President—Blue; School/Division—Yellow; Department/Division—Pink; University Enrollment Services Advance—White

Indiana University South Bend
Department of Mathematical Sciences

Simulation Modeling
M575
Morteza Shafii-Mousavi
Proposed March 5, 2002

I am proposing a new course M575 *Simulation Modeling* to be included in the IUSB mathematics curriculum. This course is at the graduate level. It is required for graduate students taking MS in Applied Mathematics and Computer Science, and it is suitable for strong undergraduate students majoring in mathematics or computer science as well as graduate students in MBA and Decision Sciences. M575 shows how to construct computerized simulations for analyzing and interpreting real phenomena. These simulations are applied to problems in a wide variety of fields, including actuarial sciences, engineering, mathematics, and physical sciences, to obtain effective and accurate solutions. The goals of the course are what a practitioner needs to know: how to use simulation to analyze a model, how to generate values of random variables from different distributions, and when to stop a simulation, etc.

Course Prerequisite: calculus course at the level of M216; a course in probability theory equivalent to M365, M360, or C455; a computer programming course at the level of C101.

Course Content:

- Introduction and Illustrative Examples
    1. Introduction.
    2. Some relatively simple stochastic systems.
    3. Construct a probabilistic model.
    4. Consider a scenario.
    5. Make some reasonable accurate assumptions concerning the scenario: a) consider the variables involved in the system; b) specify probability distributions for the variables; c) consider probability laws applied to the assumptions.
    6. Discuss whether the probability model be solved analytically.
- Review Elements of Probability
    1. Probability, Conditional probability, Independence.
    2. Random Variable, Expectation, Variance.
    3. Chebyshev's Inequality and the Law of Large Numbers.
    4. Discrete Random Variables: Binomial, Poisson, Geometric, Hypergeometric.
    5. Continuous Random Variables: Uniform, Normal, Exponential, Poisson Process & Gamma.
    6. Conditional Expectations.
- Random Numbers
    1. Pseudorandom Number Generation.
    2. Using Random Numbers to Evaluate Integrals.
- Generating Discrete Random Variables
    1. The Inverse Transform Method.
    2. Generating Random Variables: Poisson, Binomial.
    3. The Acceptance-Rejection Technique.
    4. The Composition Approach.
    5. Generating Random Vectors.
- The Discrete Event Simulation Approach
    1. Simulation via Discrete Events.
    2. Queueing Systems.
    3. Models: An Inventory Model, An Insurance Risk Model, A Repair Model.
    4. Exercising a Stock Option.
    5. Verification of the Simulation Model: a) Markov Chain Monte Carlo Methods; b) Markov Chains; c) The Hastings-Metropolis Algorithm.

Textbooks: Simulation, Sheldon M. Ross; Introduction to Operations Research, Hillier and Lieberman.

Evaluation:
1. Two mid-terms and a final exam 67%.
2. Project: Case Study 33%.