Georgia Institute of Technology
The H. Milton Stewart School
of Industrial & Systems Engineering

February 6, 2009

MEMORANDUM

TO: Institute Graduate Committee
FROM: R. Gary Parker, Associate Chair for Graduate Studies, ISyE
SUBJECT: New Course Proposal

On February 5, 2009, the faculty of the H. Milton Stewart School of Industrial and Systems Engineering approved a change-of-title to an existing course (ISyE 6831: Advanced Simulation). Technically, this calls for a new course proposal and so this submission is made to satisfy that requirement. Accordingly, we now ask the Institute Graduate Committee for its approval of new course:

ISyE 6832: Simulation Theory and Methods.

This course will serve as a required, core course for Ph.D. students in the OR Program. It should also attract advanced doctoral students pursuing the Ph.D. in Industrial Engineering as well as ones from other disciplines where an understanding of fundamental/theoretical results in simulation may be useful. With this, we also ask that ISyE 6831 be deactivated.

Recommended:

Chelsea C White III 6FEB09

Chelsea C. White, III, Chair — date
School of Industrial and Systems Engineering

Don Giddens (ZM) 2/6/09

Don Giddens, Dean, College of Engineering — date

Andy Sun for GBS 2-9-09

Gary Schuster, Interim President and Provost — date

Atlanta, Georgia 30332-0205 U.S.A.
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NEW COURSE PROPOSAL

GRADUATE Level I X Level II _____ **UNDERGRADUATE** _____

SCHOOL, DEPARTMENT, COLLEGE: ISyE **DATE:** 1/26/2009

1. Proposed Course Number: ISyE 6832 (Verify with Registrar's Office)	2. Hours: *LECTURE* 3 *LAB/RECITATION* 0 *SEMESTER CREDIT* 3

3. Descriptive Title:
Simulation Theory and Methods

4. Recommended Abbreviation for Transcript – (24 characters including spaces):

S I M U L A T I O N T H E O R Y - M E T H

5. Catalog Description – (25 words or less) Theory, algorithms, and applications of computer simulation. Topics include generalized semi-Markov processes; input-output analysis; random number, variate, and sample path generation; variance reduction techniques; and optimization via simulation. This course is intended for Ph.D. students.

6. Basis: L/G X P/F X Audit X

7. Prerequisites: ISyE 2028 or equivalent; ISyE 6761 or Math 6761

Prerequisites with concurrency:

Corequisites:

8. Has the course been taught as a special topic? NA If YES, When Enrollment

9. Is this course equivalent to another course (graduate or undergraduate) taught at Ga. Tech? If yes, list course number(s): NA

10. Are you requesting that this course satisfy: Humanities Social Science

11. Expected Mode of Presentation:	*MODE*	*% of COURSE*
	Lecture	100
	Laboratory Supervised / Unsupervised	
	Discussion	
	Seminar	
	Independent Study	
	Library Work	
	Demonstration	
	Other (Specify)	

12. Planned Frequency of Offering:	*TERM TO BE OFFERED*	*EXPECTED ENROLLMENT*
	Fall	
	Spring X	20
	Summer	

13. Probable Instructor(s) – *Please mark with an asterisk any non-tenure track individuals.*

Alexopoulos, Andradottir, Goldsman, Kim

14. Purpose of Course: Relation to other courses, programs and curricula:
This is a required, core course for the Ph.D. in Operations Research. It is also a useful elective for doctoral students in Industrial Engineering as well as from Computer Science, Mathematics, and various other units in COE.

15. Required X Elective X

16. Please attach a topical outline of the course

ISyE 6832: Simulation Theory and Methods

Textbook: Asmussen, S., and P. W. Glynn, *Stochastic Simulation: Algorithms and Analysis*, Springer, New York, 2007.

List of Topics and Minimal Reading Materials:

1. Overview of simulation.
Readings: Chapter I of Asmussen and Glynn (2007).

2. Modeling and generation of random objects:
-random variate generation,
-modeling and generation of generalized semi-Markov processes and non-homogeneous Poisson processes (for the latter, see, e.g., Section 8.6 of Law, 2007, or Leemis, 2006),
-introduction to random number generation, and
-introduction to input analysis (see, e.g., Chapter 6 of Law, 2007),
-introduction to verification and validation (see, e.g., Chapter 5 of Law, 2007).
Readings: Chapter II of Asmussen and Glynn (2007) and supplemental readings provided by instructor.

3. Transient output analysis.
Readings: Chapter III of Asmussen and Glynn (2007).

4. Steady-state output analysis.
Readings: Chapter IV of Asmussen and Glynn (2007) and Alexopoulos, Goldsman, and Serfozo (2006).

5. Variance reduction.
Readings: Chapter V of Asmussen and Glynn (2007)

6. Overview of optimization via simulation:
-derivative estimation,
-stochastic approximation,
-sample average method,
-ranking and selection,
-random search.
Readings: Chapters VII and VIII of Asmussen and Glynn (2007), Kim and Nelson (2006), and supplemental readings provided by instructor.

Desired Course Outcomes:

A. Knowledge of fundamental simulation modeling and analysis techniques.

B. Expertise in the methodology required to show the validity of simulation modeling and analysis techniques.

C. Ability to write event-driven simulation programs in a mainstream language like Fortran, C, or Java.

References:

Alexopoulos, C., D. Goldsman, and R. F. Serfozo, "Stationary Processes: Statistical Estimation," *Encyclopedia of Statistical Sciences*, Second Edition, pp. 7991-8006, edited by N. Balakrishnan, C. Read, and B. Vidakovic, John Wiley and Sons, Hoboken, NJ, 2006.

Kim, S.-H., and B. L. Nelson, "Selecting the Best System," Chapter 17 in *Handbooks in Operations Research and Management Science*, Volume 13 (Simulation), edited by S. G. Henderson and B. L. Nelson, North-Holland, Amsterdam, 2006.

Leemis, L. M., "Arrival Processes, Random Lifetimes and Random Objects," Chapter 6 in *Handbooks in Operations Research and Management Science*, Volume 13 (Simulation), edited by S. G. Henderson and B. L. Nelson, North-Holland, Amsterdam, 2006.

Law, A. M, *Simulation Modeling and Analysis*, Fourth Edition, McGraw Hill, Boston, 2007.