IE 604/ TD 604: SYSTEM DYNAMICS MODELING & ANALYSIS **Jan-Apr 2008**
Slot 3: M 10.35-11.30; Tu 11.35-12.30; Th 8.30-9.25; Room ME 207

TD 604 (System Dynamics aspect) is a half semester course. IE 604 (System Dynamics Modeling & Analysis) is a full semester course. The two courses will meet concurrently during the first half of the semester and are the same. In the second half of the semester, IE 604 continues.

Instructor Jayendran Venkateswaran, ME 319, 7533, jayendran@iitb.ac.in

Course website http://www.ieor.iitb.ac.in/~jayendran/ie604/index.html [Check site regularly]
Used for general class announcements, homework etc.

Introduction
This course will cover basics of modeling and simulation using system dynamics methodology, and control theoretic concepts for analysis of such models. Topics include:

- Introduction to systems thinking, modeling and dynamic simulation, Causal loops and feedbacks, building blocks of system dynamics: stocks and levels;
- Equations underlying the modelling, Positive and negative feedback loops, Dynamics of growth, modelling delays, co-flows & decision making, Capturing nonlinear relationships, instability and oscillation, business and supply chain models, Model validation and testing
- Control theory concepts of transfer functions, time domain analysis, state space formulation, solution of the state equation & determination of the system's response. Characteristic equation & roots; Frequency-domain techniques; Stability analysis, and design of feedback regulators, controllability & observability.
- Applications will be presented to emphasis cross-functional management issues, new product development, management of fluctuating workloads, growth and stagnation & project management.

Course Topics

Systems Thinking	Modeling Human Behavior
Causal Loop Diagrams	Modeling Non-linear relationships
Dynamics of Stocks and Flows	Instability and Oscillations
Dynamics of Growth	Modeling Supply Chains
Modeling Delays	Timing & Integration
Validation and Model Testing	Control Theory
Modeling Decision Making	Applications & Cases

Textbook/ References

1. John Sterman, *Business Dynamics: Systems Thinking and Modeling for a Complex World*, Irwin/McGraw-Hill (2000).
2. Craig W. Kirkwood, *System Dynamics: A Quick Introduction*, Arizona State University (1998) [Available online at: http://www.public.asu.edu/~kirkwood/sysdyn/SDIntro/SDIntro.htm]
3. Norman Nise, *Control Systems Engineering*, 4th ed., John Wiley and Sons (2004)
4. Sushil, *System Dynamics: A Practical Approach for Managerial Problems*, Wiley Eastern (1993)
5. J. W. Forrester, *Industrial Dynamics*, Cambridge MA: Productivity Press (1961)
6. Peter Senge, *The Fifth Discipline*, Currency (2006)

Computer Usage

1. Powersim® / Vensim® / iThink® (or any other SD software)

Measurement of outcomes (TBD)

Final Exam	Midterm Exam	Assignments	Quizzes
Project/ Presentation	Others		

Audit Students: Must have sufficient performance to obtain a CC & should maintain sufficient attendance.

Cheating, copying and plagiarism is NOT allowed in assignments, quizzes, exams etc. Detection of such practices will result in the appropriate penalties as prescribed by the Institute. Please make sure that whatever you submit under your name is your own work. Attendance is compulsory to clear the course, as per the Institute rules.