



INTRODUCTION TO SYSTEM DYNAMICS MODELING

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Operations Research
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INTENDED AUDIENCE : All Engineering students

INDUSTRIES APPLICABLE TO : TCS, General Mills, etc

COURSE OUTLINE :

This course will introduce students to systems thinking and system dynamics (SD) methodology, to model, simulate, analyze, understand and discuss complex issues. SD focusses on the structure and dynamic behavior of systems composed of interacting feedback loops. The system structure is captured using causal loop diagrams (CLDs) or stock-flow diagrams (SFDs). This course will introduce model-building using CLDs and SFDs notations. Examples and scenarios will be drawn from various business, social, economic, environmental and ecological systems.

ABOUT INSTRUCTOR :

Prof. Jayendran Venkateswaran (JV) is a Professor of Industrial Engineering and Operations Research at IIT Bombay, where he has been a faculty since 2005. His current research and teaching interests are in modelling and analysis of complex socio-economic systems, systems modelling and simulation, last mile supply chain ecosystem, and energy access. Over the years, he has worked with various multi-national industries, helping them solve their problems using sound Operations Research methods. He loves tinkering with Python/ R/ other open source tools. He is passionate about popularising OR, and Systems Thinking to help further the understanding of complex systems.

COURSE PLAN :

Week 1: Introduction to Systems Dynamics/ Systems Thinking Causal Loop Diagramming

Week 2: Stock-Flow Diagrams and Graphical Integration/ Differentiation

Week 3: Dynamics of Simple Structures: Reinforcing loops and Balancing Loops

Week 4: S-Shaped Growth Dynamics; Innovation Diffusion

Week 5: Modeling Delays, Modeling Oscillations

Week 6: Nonlinearities and Table Functions

Week 7: Model Verification and Validation

Week 8: Modeling Exercises, Case Studies, and course wrap-up