

<b>COURSE NUMBER:</b> IE 5545, 4 credits	<b>COURSE TITLE:</b> Decision Analysis
<b>TERMS OFFERED:</b> Spring	<b>PREREQUISITES:</b> Knowledge of statistics and probability at the level of IE 4521 or Instructor approval
<b>TEXTBOOKS/REQUIRED MATERIAL:</b> Clemen, R. T. and Reilly T. 2001. Making Hard Decisions with Decision Tools, Duxbury.	<b>COGNIZANT FACULTY:</b> Professor Diwakar Gupta  <b>DATE OF PREPARATION:</b> May 5, 2007
<b>COURSE LEADER(S):</b> Professor Diwakar Gupta	<b>CLASS/LABORATORY SCHEDULE:</b> One 240 minute class per week <b>CONTRIBUTION OF COURSE TO MEETING PROFESSIONAL OBJECTIVES:</b> 100% engineering topics
<b>CATALOG DESCRIPTION:</b> This course surveys normative theories of decision making, with a particular emphasis on structuring of hard decision problems arising in a variety of engineering, business, and public policy contexts. Topics discussed include decision trees, expected utility theory, screening prospects by dominance, assessment of subjective probability, multiple attribute utility, analytic hierarchy process, value of information, multistage decision problems, benchmarking with data envelopment analysis, and basics of game theory (including auctions and bids).	<b>COURSE TOPICS:</b> <ol style="list-style-type: none"> <li>1. Modeling decisions – common decision criteria and their critique, structuring decision problems, defining objectives and values, constructing an objectives hierarchy, visual aids (decision trees and influence diagrams), cash flows and probabilities, solving decision trees and influence diagrams.</li> <li>2. Sensitivity analysis</li> <li>3. Probability basics – probability axioms and formulae, Bayes’ theorem</li> <li>4. Theoretical probability distributions</li> <li>5. Subjective probability</li> <li>6. Stochastic dominance</li> <li>7. Incorporating new information – natural conjugate distributions</li> <li>8. Value of perfect and sample information</li> <li>9. Modeling preferences – risk, utility axioms, paradoxes, and implications</li> <li>10. Modeling conflicting objectives – multiplicative and additive independence, multi-attribute utility theory</li> <li>11. Analytical Hierarchy Process</li> <li>12. Benchmarking via Data Envelopment Analysis</li> <li>13. Game theory</li> <li>14. Multistage decision making and other applications of decision analysis</li> </ol>

<p><b>COURSE OBJECTIVES</b></p>	<ol style="list-style-type: none"> <li>1. To introduce students to the difficulties in making decisions owing to (a) Complexity inherent in the problem, (b) Uncertainty inherent in the problem, (c) Multiple (often competing) objectives, and (d) Many stakeholders and therefore many different perspectives.</li> <li>2. To explore a variety of methods developed in engineering, business, economics and social sciences literature to deal with complex decision problems</li> <li>3. To train students to think fundamentally about how to structure complex decision problems and how to obtain data necessary for analyzing such decision scenarios</li> <li>4. To train students in techniques used to assess utilities and subjective probabilities, while avoiding biases and errors, and to combine these assessments to reach a recommendation for the decision maker</li> <li>5. To train students in techniques used to incorporate new information and to determine whether such information is valuable</li> <li>6. To expose students to decision problems involving multiple attributes</li> <li>7. To expose students to basics of non-cooperative game theory</li> <li>8. To expose students to @RISK, a leading software in decision modeling</li> </ol>
<p><b>COURSE OUTCOMES</b></p>	<ol style="list-style-type: none"> <li>1. Students learn to model complex decision problems [a, e, h, j, k]</li> <li>2. Students learn a plethora of methodologies for analyzing difficult decision problems while taking into account uncertainty, risk preferences, multiple objectives and multiple stakeholders [a, b, c, e, .f, g, h, i, j, k]</li> <li>3. Students learn how to incorporate risk (uncertainty) and how to update representation of uncertainty in decision problems based on new information [b, c, e ]</li> <li>4. Students learn how to analyze decision problems posed in business cases while working in teams [d]</li> <li>5. Students learn how to communicate their results in writing and orally to lay and engineering audience [g]</li> </ol>
<p><b>ASSESSMENT TOOLS:</b></p>	<ol style="list-style-type: none"> <li>1. Exams – One examination during the term and one final exam</li> <li>2. Assignments – 7 assignments during the term (approximately 1 every 2 weeks)</li> <li>3. In-class presentation – each group presents a paper describing an application of decision analysis</li> <li>4. Case discussions – 4-5 business cases are discussed in class during the semester</li> </ol>

**IE 5545**

*Nature of Changes*

*This is an entirely new document; no previous versions of this document exist.*