# Subject Description Form

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| **Subject Code** | AMA484 |
| **Subject Title** | Decision Analysis |
| **Credit Value** | 3 |
| **Level** | 4 |
| **Pre-requisite/ Co-requisite/ Exclusion** | Pre-requisite: Probability and Distributions (AMA269 or AMA2691) or Inferential Statistics (AMA237) or Basic Statistics (AMA261) |
| **Objectives** | This subject is to enable students to understand the theory and methods for decision analysis under uncertainty, to appreciate the use of expert judgment and value of information in decision making and risk management, and to apply them in industrial and financial areas. |
| **Intended Learning Outcomes** | Upon satisfactory completion of the subject, students should be able to:<br>1. discuss the basic principles and assumptions for decision analysis;<br>2. synthesize the decision making knowledge and techniques required in solving real-life problems;<br>3. formulate mathematical models for practical decision problems, and assess critically the appropriateness of model used;<br>4. solve decision problems and present decision analysis results;<br>5. make recommendations for actions based on analysis results;<br>6. define, formulate and solve problems in a systematic approach;<br>7. communicate effectively in a well-structured manner and build up an open-minded attitude. |
| **Subject Synopsis/ Indicative Syllabus** | *Preliminary probability theory: (6 hours)*<br>Review of probability theory, prior and posterior distributions, Bayes' theorem, choice of prior: bets, conjugate families of distributions, vague and improper priors.<br>*Structure of decision analysis models: (9 hours)*<br>Nature and classification of decision analysis problems, influence diagrams, decision trees, Bayesian intervals for parameters and predictions, decision analysis with sampling, expected value of information (perfect and imperfect), sensitivity analysis.<br>*Decision analysis under uncertainty: (6 hours)*<br>The maximin/maximax/Laplace criterion, criterion of realism, the minimax regret criterion, minimax decisions and Bayes' solutions including simple results, game theory.<br>*Decision analysis under risk: (6 hours)*<br>Risk attitudes, measures of risk, risk premium, subjective measures and utility theory.<br>*Decision analysis with multiattributes: (7 hours)*<br>Conflicting objectives, analytic hierarchy process, goal programming, multi-attribute utility models, Pareto optimal, efficient frontier.<br>*Applications: (8 hours)*<br>Capital investment, inventory control, other industrial and financial applications. |

**Teaching/Learning Methodology**

The subject will be delivered mainly through lectures and tutorials. The lectures will be conducted to introduce the concepts of decision analysis in the syllabus, which are then reinforced by learning activities involving demonstration, tutorial exercise and assignments.

**Assessment Methods in Alignment with Intended Learning Outcomes**

| Specific assessment methods | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| a. Assignments | 20% | ✓ | | ✓ | | | | ✓ |
| b. Tests | 20% | | | ✓ | ✓ | | | |
| c. Examination | 60% | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Total | 100 % | | | | | | | |

Continuous Assessment comprises of assignments and tests. A written examination is held at the end of the semester.

To pass this subject, students are required to obtain Grade D or above in **both** the Continuous Assessment and the Examination components in order to satisfy all the intended learning outcomes.

**Student Study Effort Required**

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| Class contact: | |
| ▪ Lecture | 28 Hrs. |
| ▪ Tutorial | 14 Hrs. |
| Other student study effort: | |
| ▪ Assignment | 40 Hrs. |
| ▪ Self-study | 30 Hrs. |
| Total student study effort | 112 Hrs. |

**Reading List and References**

Textbook:

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|---|---|---|
| Winston, W.L. | Introduction to Probability Models: Operations Research, Volume II<br>4th edition | Brooks/Cole<br>2004 |

References:

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|---|---|---|
| Pratt, J.W., Raiffa, H. & Schlaifer, R. | Introduction to Statistical Decision Theory | The MIT Press<br>2008 |
| Goodwin, P. & Wright, G. | Decision Analysis for Management Judgment<br>4th edition | Wiley<br>2010 |
| Clemen, R.T. & Reilly, T. | Making Hard Decisions with Decision Tools<br>1st edition | Duxbury Press<br>2003 |