Quantitative Methods in Systems Engineering

Note: Items preceded by a star (★) are graded with due dates in red below.

WELCOME TO THE COURSE (30 min)

In the first section of the course, you'll take a Pre-Assessment to get a baseline of your understanding of the course material. During this period, you'll become familiar with the platform and course design.

- ★ Pre-Assessment (15 min)
  Due: Final day of the course
- Welcome (2 min)
- Course Discussion Forums (5 min)
- Course Webinars (5 min)
- Teams (3 min)
- Who's Teaching the Course (4 min)
- Connect with MIT xPRO (1 min)

WEEK 1: MAKING EARLY TRADEOFF DECISIONS (4-6 hrs)

In Week 1, you will first work through quantitative methods that do not require a model, such as the Pugh method. You will spend time on generating concepts for evaluation, and get an overview of how to structure a trade study.

- Key Ideas (10 min)
- Framing Early Decisions (55 min)
- Concept Selection Methods (45 min)
- Overview of Trade Studies (30 min)
- ★ Graded Activity (20 min)
  Due: Final day of the course
- Trade Studies in Practice (20 min)
- ★ Project (2 hrs)
  Project Submission and Self-Assessment due Sunday of the first week at 23:30 UTC
- Key Takeaways (2 min)

Live Event This Week
Course TA Office Hour Webinar
Date & Time TBD
More information in Welcome to the Course > Course Webinars section

WEEK 2: VALUE-ORIENTED DECISION MAKING (4-6 hrs)

In Week 2, you will begin the process of tradespace exploration by defining value - a key metric by which designs are compared. You will work from a notion of value to a process for developing a model of value. You will learn to characterize a design using attributes and how to organize attributes in hierarchies for evaluation and summation.

- Key Ideas (10 min)
- Framing Decision Making and Tradeoffs (10 min)
- Value-Focused Thinking and Value-Driven Design (20 min)
- Developing Value Models (35 min)
- Operationalizing Value Models (50 min)
- ✯ Graded Activity (20 min)
  Due: Final day of the course
- ✯ Project (2 hrs)
  Project Submission and Self-Assessment due Sunday of the second week at 23:30 UTC
  Peer Assessments due Monday of the third week at 23:30 UTC
- ✯ Action Plan (20 min)
  Due: Final day of the course
- Key Takeaways (2 min)

WEEK 3: GENERATING AND EVALUATING ALTERNATIVES (4-6 hrs)

For Week 3, you'll start by creating a variety of designs for evaluation and explore how design decisions are combinatorially paired and sampled to generate a design space. You'll then define how these designs will be evaluated in terms of value (Week 2) and other outputs, such as cost and performance. Finally, you will be introduced to tradespace visualization - how we represent the output of the search for great designs.

- Key Ideas (8 min)
- Generating Design Spaces (45 min)
- Evaluating Design Spaces (25 min)
- Tradespace Representations, Visualizations, and Interactions (35 min)
- ✯ Graded Activity (20 min)
  Due: Final day of the course
- ✯ Project (2 hrs)
  Project Submission and Self-Assessment due Sunday of the third week at 23.30 UTC
  Peer Assessment due Monday of the fourth week at 23:30 UTC
- Key Takeaways (3 min)

Live Event This Week
Course Q&A Webinar with Course Faculty
Date & Time TBD
More information in Welcome to the Course > Course Webinars section

WEEK 4: TRADESPACE EXPLORATION AND ANALYSIS (4-6 hrs)

In Week 4, after reviewing the creation of the tradespace, you will begin the interpretation of the results by looking for patterns in the tradespace, such as clusters and the Pareto Front. You will define what sensitivity means for a design in the tradespace and reflect on how uncertainty can be captured and represented. Finally, you'll close with a review of task allocation between models and people in the design process.

- Key Ideas (10 min)
- Identifying Key Features and Patterns (50 min)
- Determining Sensitivity and Robustness (40 min)
- ✯ Graded Activity (20 min)
  Due: Final day of the course
- Humans, Methods, and Models (10 min)
- ✯ Project (2 hrs)
  Project Submission and Self-Assessment due by Sunday of the fourth week at 23:30 UTC
- ✯ Action Plan (20 min)
  Due: Final day of the course
- Key Takeaways (2 min)
- Share Your Quantitative Methods Project File (10 min)
- Course and Program Wrap-Up (8 min)
- Exit Survey (10 min)
- ✯ Post-Assessment (15 min)
  Due: Final day of the course

Top 10 Questions
Key Ideas Section
Questions due by 21:00 UTC on Friday
Responses posted by 21:00 UTC on Monday

AFTER THE COURSE ENDS

Day the Course Ends at 23:30 UTC

- Graded assignments no longer accepted
- Discussion Forums lock
- Course staff will no longer monitor or update course content

Friday after the Course Ends

- Course certificate available on MIT xPRO dashboard
- Systems Engineering program certificate available on MIT xPRO dashboard