

# Summer Course Program

## Solving Complex Problems: Structured Thinking, Design Principles and AI

	<u>Understanding Problems</u>	<u>Finding Concepts</u>	<u>Systems Architecting</u>	<u>AI for Design</u>	<u>Epilogue</u>
	Mon	Tue	Wed	Thr	Fri
8:30-9:00 AM	Light breakfast with Q&A				
09:00 – 10:25 AM	<b>S. Kim</b> <b>Session 1: Course intro, Understanding systems and complexity</b> - Functional thinking - Axiomatic Design Framework - AI for Design Fundamentals of Axiomatic Design (I) - Independence Axiom	<b>S. Kim</b> <b>Session 4: Concept generation and embodiment:</b> - Case study: System design approach to healthcare systems Fundamentals of Axiomatic Design (II) - Information Axiom - What is a complex system?	<b>S. Kim</b> <b>Session 7: Complexity and Systems Design</b> - Software system design - Micro/Nano systems - Organizational systems	<b>S. Kim</b> <b>Session 10: AI for Design: a new paradigm with hybrid intelligence</b>	<b>S. Kim, H. Akay</b> <b>Session 13: AI for Systems: Digital thread, I4.0, and Manufacturing Genomes</b> System architecting, functional thinking and systems integration. Review and wrap up.
	Break				
10:35 – 12:00 AM	<b>J. Gans</b> <b>Session 2: System Analysis Approach</b> - LL Projects - Definitions - Basics Problem Definition - Up/Down thinking	<b>T. David, J. Gans</b> <b>Session 5: Developing structure: Pitfalls, Tools, and Techniques for System Analysis</b> Systems analysis Checklist - System Analysis Steps - Example tools	<b>B. Atkins, J. Gans</b> <b>Session 8: Blue team innovation approach</b> - innovation approach - Understanding the customer - Find a solution	<b>J. Gans</b> <b>Session 11: Defense systems analysis examples</b> - Red Teaming - Back of Envelope modeling - Assessing with rigor - Summarizing results Story Telling - Elements of a story - Adding excitement - Presentation tips and tricks	<b>S. Kim</b> <b>Session 14: Final Project Presentations and Reflection (Milestone Five)</b>
	Lunch				
01:00 – 03:30 PM	<b>S. Kim, all</b> <b>Session 3: Project session I: Choosing Problem to Solve; Concept Generation; Pre-course interview* (Milestone One).</b>	<b>S. Kim, all</b> <b>Session 6: Project session II:</b> - Structured problem statement, concepts generation and refinement (Milestone Two).	<b>S. Kim, all</b> <b>Session 9: Project session III: Critical concepts and Solution Generation (Milestone Three)</b>	<b>J. Gans, all</b> <b>Session 12: Project session IV: Technical Review with Surgical Assessment. (Milestone Four)</b>	<b>S. Kim, R. Shin</b> <b>Session 15: Final Project Presentations and Reflection Continued.</b> Summary, Recap & Epilogue <u>*Course concludes at 3:30 PM</u>
3:30 – 4:00 PM	Break and Q&A				
03:40 – 05:00 PM	<b>Working Social Hour (TBD)</b>	<b>S. Kim</b> Self-study, project Q&A	<b>S. Kim</b> Self-study, project Q&A	<b>Course Dinner (Place TBD)</b>	

\* Pre-class interview will be made a week before the class starts, individually with the course instructor, Prof. Kim.  
 Contact: Prof. Sang-Gook Kim, sangkim@mit.edu