

## MS4663 – Engineering Solutions by Design Thinking

<b>Course Code</b>	MS4663				
<b>Course Title</b>	Engineering Solutions by Design Thinking				
<b>Pre-requisites</b>	NIL				
<b>Pre-requisite for</b>	NIL				
<b>No of AUs</b>	3				
<b>Contact Hours</b>	Studio Contact	39			

### Course Aims

In this course you will engage with the versatile investigation and problem-solving process known as design thinking. You will experience new ways of gaining insights when designing for a situation, where the emphasis is on human considerations, as you develop a process, and respond with solutions that are appropriate to the intended audience. This course will compliment any discipline of design, technology, development, or production were the final result will involve human participation.

### Intended Learning Outcomes (ILO)

By the end of this course, you (as a student) would be able to:

1. Describe the ideology and processes of design thinking and how it differs from other design and development methods.
2. Develop a unique design process that is in response to a specific human-centred situation.
3. Apply creative and inventive techniques to develop a responsive design concept through to prototype stage.
4. Demonstrate a prototype solution supported with rationale that responds to human-centred situation.
5. Constructively discuss and critique design thinking approaches, processes and solutions employed by peers.

### Course Content

In this course, you will bring your own discipline's experience to the creative process of design thinking. You will join up in teams with students from different backgrounds, and together you will employ an innovative investigation processes to understand a topic and respond with creative solutions.

### **Seminars**

In-class seminars and mini-lectures will outline the history, background, and theory of design thinking, and how it has emerged as a central problem-solving process in society today. You will learn about how this way of thinking has infused into a wide range of sectors, including business, technology, education, commerce, engineering, and the challenge of “wicked” problems.

### **Projects and workshops**

In a studio environment, you will practice the various stages of design thinking:

- Selection of a topic: You will select, or be given, a human-centred topic.
- Empathy: The first stage is to understand the problem from the point of view of those experiencing the problem. This will involve a range of methods, including observation, engagement, interviewing, or immersion. Key to this approach is to put aside your own pre-conceived notions and be open to learning a new point of view.
- Ideation: This refers to the formation and generation of ideas and relationships. Ideation methods include brainstorming, mind-mapping, sticky-notes ideation, fast-ideation, deep analysis, divergent and convergent thinking. The results are analysed for patterns or insights that may reveal avenues to develop a design response.
- Prototyping, testing and iteration: Possible solutions are rapidly prototyped, reviewed, and iterated. This may involve the construction of objects, role play, interface mock-ups, paper prototyping, and any other form of fast-prototype testing. Response from users are then to inform the next round of prototyping and testing, until a design is refined enough to be presented as a solution.

### **Teamwork**

In this course you will frequently work in a team. When in a team, you will be additionally assessed on:

- Collaborative achievement: How well the team meets the project brief in a way that surpasses the capabilities of a single individual.
- Collaborative creativity: How well the team demonstrates initiative, exploration, and creativity, combining the separate skills and abilities of the individuals to expand and generate new creative outcomes.
- Individual growth: How much you grow as an individual within the team. This could be artistic, technical, or team-related such as team management.
- Individual contribution: How effective your contribution is to the team. This includes performing your role as expected or exceeding expectations in areas such as meeting deadlines and contributing to key moments such as presentations, screenings, discussions, and submissions.
- Team relationship: This includes inter-personal team relationships, with aspects such as positive engagement, readiness to contribute, value of communication, sharing of ideas, fairness, and peer support. You may also be assessed on team management and leadership.

## Reading and References

1. Borgmann, A. The depth of design. In R. Buchanan, & V. Margolin (Eds.), *Discovering design: Explorations in design studies* (pp. 13-22). Chicago, IL: The University of Chicago Press. 1995.
2. Brown, T., & Wyatt, J. Design thinking for social innovation. *Stanford Social Innovation Review*, 8(1), 30-35. 2010.
3. Brown, T. Katz, B. *Change by design : how design thinking transforms organizations and inspires innovation*. Harper Business. 2009.
4. Buchanan, R. Wicked problems in design thinking. *Design Issues*, 8(2), 5-21. 1992.
5. Dorst, K. The core of 'design thinking' and its application. *Design Studies*, 32(6), 521-532. 2011.
6. Gray, C., & Malins, J. *Visualizing research*. Ashgate. 2004.
7. IDEO's The Field Guide to Human-Centred Design (<http://www.designkit.org//resources/1>)
8. IDEO [www.ideo.com](http://www.ideo.com)
9. Kelly, T. Littman, J. *The art of innovation : lessons in creativity from IDEO, America's leading design firm*. Harper Collins Business. 2001
10. Kolko, J. Abductive thinking and sensemaking: The drivers of design synthesis. *Design Issues*, 26(1), 15-28. 2010
11. Myerson, J. *Ideo : masters of innovation*. Laurence King. 2004
12. Noble, I., & Bestley, R. *Visual research: an introduction to research methodologies in graphic design*. Ava Publishing. 2004.
13. Patnaik, D. Mortensen, P. *Wired to care : how companies prosper when they create widespread empathy*. FT Press 2009
14. Pilloton, E. Chochinov, A. *Design revolution : 100 products that are changing people's lives* Thames & Hudson. 2009.
15. Schon, D. *The Reflective Practitioner*. London: Temple-Smith. 1983.
16. Schön, D. Designing as reflective conversation with the materials of a design situation. *Knowledge-Based Systems*, 5(1), 3-14. 1992
17. Stanford d.school's Bootcamp Bootleg (<https://dschool.stanford.edu/resources/design-thinking-bootleg>)
18. Winner, L. Do artifacts have politics? *Daedalus*, 109(1), 121-136. 1980
19. \*This list will be continually updated as new research and resources become available.

## Course Policies and Student Responsibilities

### (1) General

You are expected to complete all assigned readings, activities, assignments, attend all classes punctually and complete all scheduled assignments by due dates. You are expected to take responsibility to follow up with assignments and course related announcements. You are expected to participate in all project critiques, class discussions and activities.

### (2) Punctuality

You are expected to be punctual for all classes. If you are more than 30 minutes late, you

will be deemed as absent and will not be able to sign on the attendance register.

### **(3) Absenteeism**

In-class activities make up a significant portion of your course grade. Absence from class without a valid reason will affect your participation grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies. There will be no make-up opportunities for in-class activities.

### **Academic Integrity**

Good academic work depends on honesty and ethical behavior. Quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honor Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student of NTU, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at the University. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, and collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the [academic integrity website](#) for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.