

## Design and Innovation in the Social Domain

ENGR 3003 (3 Credits / 45 hours)

### Jordan: Engineering and Design for Sustainable Environments

*This syllabus is representative of a typical semester. Because courses develop and change over time to take advantage of unique learning opportunities, actual course content varies from semester to semester.*

#### Description

This course aims to provide engineering students and students interested in human-action with the opportunity to study human-centered design methods and ethics in the context of Jordan. Students collaborate with local NGOs and community members to interview, research, assess needs, and identify a local engineering problem. While Jordan has been developing innovative approaches to water shortage, storage and supply, organic farming, food security, and sustainable energy production, the country still faces increased water needs from climate change and a growing population including refugees. Design and Innovation in the Social Domain seminar brings students and local communities together in collaborative and hands-on designs to identify an existing problem and engineer a concept idea that can be developed into a design project and eventually a prototype. Students will think through engineering solutions to existing problems in water and renewable energy in arid environments, food design or sustainable organic farming. The aim is for students to weave emergent thinking into a design innovation, prototype a solution when they are back at their school, and eventually share the solution with the community it was designed for.

#### Learning Outcomes

The *Design and Innovation in the Social Domain* course comprises 45 class hours of instruction (3 credits). Upon completion of the course, students will be able to:

- Identify an existing engineering problem and formulate the problem into design goals;
- Develop the capacity to assess community needs in the context of Jordan and engineer possible solutions to existing problems;
- Analyze, compare, and evaluate alternative engineering designs to existing problems;
- Develop and assess concept selection in observance of local ethics and value systems;
- Process background research for an engineering concept design and delineate ethical standards for implementation;

#### Language of Instruction

This course is taught in English, but students will be exposed to vocabulary related to course content as well as the nuances of economic change and development through in-country expert lectures and field visits in a wide range of venues and regional locales.

## Course Schedule

Students will be provided a detailed course schedule during orientation on the program. Please be aware that topics and excursions may vary to take advantage of any emerging events, to accommodate changes in our lecturers' availability, and to respect any changes that would affect student safety. Students will be notified if this occurs.

### Module 1: Human-Centered Design in the Context of Jordan

This module introduces human-centered design and the goals of interaction in design selection and implementation. The module also focuses on the environmental challenges that Jordan face in terms of water, energy and agriculture.

#### Topics include:

- Human-Centered Design: Definition, Approaches, and Challenges
- Meeting with a Local Designer: Sahar Madanat ([www.saharmadanat.com](http://www.saharmadanat.com))
- Meeting with an Environmental Designer: Maher Maimoun.
- Water resources and sustainability in Jordan
- Renewable energy opportunities in Jordan (small- and large-scale projects)
- Agriculture in Jordan and sustainable strategies

#### Excursions:

- Royal Botanic Garden (water resource management)
- King Talal Dam (the biggest Dam in Jordan, collects around 60 million cubic meters used in Agriculture)
- Wadi Araba and Jordan Valley (water justice and Agriculture)

#### Required Readings:

Giacomini, J. (2014). What Is Human Centered Design? *The Design Journal*, 17:4. Retrieved: <http://hcdi.brunel.ac.uk/files/What%20is%20Human%20Centred%20Design.pdf>

Cary, J. (2013). What is Design, if Not Human Centered? *Stanford Social Innovation Review*.

Altz-Stamm, A. (2012). Jordan's water resource challenges and the prospects for sustainability. *GIS for Water Resources*.

van der Bijl-Brouwer, M., & Dorst, K. (2017). Advancing the strategic impact of human-centred design. *Design Studies*, 53, 1-23.

Ceschin, F., & Gaziulusoy, I. (2016). Evolution of design for sustainability: From product design to design for system innovations and transitions. *Design Studies*, 47, 118-163.

Jordan Ministry of Agriculture. (2011). The Agricultural Sector in Jordan...Reality and Goals. Retrieved from:

<http://moa.gov.jo/LinkClick.aspx?fileticket=IGjWN5Sx6al%3D&tabid=570&mid=744&language=ar-JO>

Export.Gov. (2018). Jordan – Agricultural Sectors. Retrieved from:

<https://www.export.gov/article?id=Jordan-Agricultural-Sectors>

#### Recommended Readings:

Ahmad, S., Wong, K. Y., Tseng, M. L., & Wong, W. P. (2018). Sustainable product design and development: A review of tools, applications and research prospects. *Resources, Conservation and Recycling*, 132, 49-61.

- Carey, M., White, E. J., McMahon, M., & O'Sullivan, L. W. (2019). Using personas to exploit environmental attitudes and behaviour in sustainable product design. *Applied Ergonomics*, 78, 97-109.
- Quan, S. J. (2019). Smart Design for Sustainable Neighborhood Development. *Energy Procedia*, 158, 6515-6520.
- Jamiya Project. (2016). Human-Centered Design within Human-Centered Design within ... Retrieved: <https://medium.com/@JamiyaProject/human-centered-design-within-human-centered-design-within-6ff7df47c4eb>
- USAID. (2019). Jordan Water Resources and Environment. Retrieved from: <https://www.usaid.gov/jordan/water-and-wastewater-infrastructure>

## Module 2: Engineering Water in Jordan

This module focuses on the innovative methods in the design, harvesting, and conservation of water in Jordan. The module combines lectures by experts and field visits to water innovation projects.

### Topics include:

- Rain Harvesting System Design and Construction: Pilot Projects
- Water Conservation and Management in Arid and Semi-Arid Regions: Al-Azraq oasis project
- Low-Cost Eco-Bio Technological Methods for the Purification and Reuse of Domestic Wastewater
- Gray Water Reuse for Green Refugee Camps
- Water Tank Design

### Excursions:

- Al Baqaa Palestinian camp
- Dana nature reserve
- Ancient Water harvesting System (Petra)
- Wadi Rum community farmers (small scale farmers) and visit Disi project

### Required Readings:

- Jamrah, A., & Ayyash, S. (2008). Greywater generation and characterization in major cities in Jordan. *Jordan Journal of Civil Engineering*, 2(4), 376-390.
- Aljaradin, M., & Aboulila, T. S. (2011). Evaluation of using grey water as an alternative irrigation source in Jordan. *Vatten: tidskrift för vattenvård/Journal of Water Management and research*, 67(2), 119-122.
- Hadadin, N., Qaqish, M., Akawwi, E., & Bdour, A. (2010). Water shortage in Jordan— Sustainable solutions. *Desalination*, 250(1), 197-202.

### Recommended Readings:

- The Inter-Islamic Network on Water Resources Development and Management. (2007). *Studies of IDRC Supported Research on Greywater in Jordan Conducted by INWRDAM*. Retrieved from: <http://inwrdam.org/jo/wp-content/uploads/2018/07/INWRDAM-booklet-on-greywater-research-outcomes-2008-English-Version.pdf>
- European Commission DG Environment News Alert Service. (2015). *Sustainable management of water in an arid region: water supply measures compared (continued)*. Retrieved from: [http://ec.europa.eu/environment/integration/research/newsalert/pdf/sustainable\\_management\\_of\\_water\\_in\\_an\\_arid\\_region\\_413na5\\_en.pdf](http://ec.europa.eu/environment/integration/research/newsalert/pdf/sustainable_management_of_water_in_an_arid_region_413na5_en.pdf)

### **Module 3: Human-Centered Design in the Context of Humanitarian Crisis**

This module addresses the principles, rights, and duties governing humanitarian action as set out in the humanitarian charter. The module examines the major sectors of humanitarian response and looks into humanitarian innovation in each sector.

#### *Topics include:*

- Introduction to Refugee Humanitarian Action
- Humanitarian Innovation and Water Supply, Sanitation, and Hygiene
- Humanitarian Innovation in the Sector of Shelter and Settlement
- Collaboration, Intervention, and Resilience in the Context of Displaced Populations
- Human-Centered Design Workshop: Engineering Practical Solutions

#### *Required Reading:*

Louise Bloom, Louise and Betts, Alexander (2013) *The two worlds of humanitarian innovation*. Working Papers Series NO. 94. Oxford: Refugee Studies Centre,

### **Module 4: The Ethics of Interaction with Vulnerable Populations**

This module addresses the methodological and ethical challenges and considerations in social science research on vulnerable populations with special focus on refugees and displaced populations. The module explores the cultural and social norms that should be considered when interacting with or interviewing refugees.

#### *Topics include:*

- Methodological and Ethical Consideration of Interaction with Vulnerable Populations
- Structured and Semi-Structured Interviewing with Rural Populations
- Interacting with Refugee Populations
- Ethics and Gender-Related Vulnerabilities

#### *Required Readings:*

Pittaway, F, Bartolomei, L. Hugman, R. (2010). "Stop Stealing Our Stories": The Ethics of Research with Vulnerable Groups." *Journal of Human Rights Practice*, 2(2):229-251.

Voutira, E. and Dona, G. (2007). Refugee Research Methodologies: Consolidation and Transformation of a Field. *Journal of Refugee Studies*, 20(2):163-171.

Jacobsen, K. Landau, L.B. (2003). The Dual Imperative in Refugee Research: Some Methodological and Ethical Considerations in Social Science Research on Forced Migration. *Disasters*, 27(3):185.

Block, K. (2013). Addressing Ethical and Methodological Challenges in Research with Refugee-background Young People: Reflections from the Field. *Journal of Refugee Studies* 26 (1): 69-87.

McKown, L. (2016). Applying Human-Centered Design to Refugee Challenges in Dadaab, Kenya. Retrieved: <https://www.idin.org/blog-news-events/blog/applying-human-centered-design-refugee-challenges-dadaab-kenya>

### **Module 5: Needs Assessment in the Context of Jordan**

Students work with local community members to complete a needs assessment of community engineering challenges. Through this process students and community members collaborate on: identifying concerns, determining measurable indicators, gathering data to define needs, identifying and analyzing causes, and identifying possible solutions.

*Topics include:*

- Cultural Probes: Qualitative Contextual Design Research
- Ethnological Methods
- Participatory Co-Design Workshop
- Design Ethnography

*Required Readings:*

Forlizzi, J. (2008). The product ecology: Understanding social product use and supporting design culture. *International Journal of design*, 2(1).

Dourish, P. (2006). Implications for design. In *Proceedings of the SIGCHI conference on Human Factors in computing systems* (pp. 541-550). ACM.

*Videos:*

Video: Qualitative Contextual Design Research. Accessed:  
[https://www.thedesignexchange.org/design\\_methods/162](https://www.thedesignexchange.org/design_methods/162)

Video: What is Co-Design? Accessed:  
[https://www.thedesignexchange.org/design\\_methods/129](https://www.thedesignexchange.org/design_methods/129)

Video: What is Ethnography? Accessed:  
[https://www.thedesignexchange.org/design\\_methods/340](https://www.thedesignexchange.org/design_methods/340)

*Online Resources:*

Needs assessment process. Retrieved: <https://etc.usf.edu/broward/mod1/module1.html>

Conducting assessment needs surveys. Retrieved: <http://ctb.ku.edu/en/table-of-contents/assessment/assessing-community-needs-and-resources/conducting-needs-assessment-surveys/main>

Design Methods. Accessed: [https://www.thedesignexchange.org/design\\_methods](https://www.thedesignexchange.org/design_methods)

## **Evaluation and Grading Criteria**

### Description of Assignments:

Cultural Probes assignments (20%): Cultural probes are used to gain insight into and inspirational responses about the daily life and habits of communities. Students are given probes along with tasks to allow them to record specific events, feelings, or interactions.

### Sketching exercises (20%):

each week, the class will be given a theme or a specific design problem to tackle for which each student will draft sketches of design solutions related to that topic. Drawing skills are not being evaluated; these exercises are intended to help students develop facility in ideation and visually communicating ideas. Creativity is encouraged.

### Human-centered Design exercises (30%):

Students will complete two individual assignments to practice applying the various methods of human-centered design.

### Background Research for Design Project (20%):

Students complete background research on their engineering concept project design and delineate ethical standards for its implementation.

### Participation (10%):

Students are expected to show up prepared for class, and having completed the appropriate readings, participate in class discussions, field activities, and carry out all assignments and other activities.

### Assessment:

Cultural Probes assignments	20%
Sketching exercises	20%
Human-Centered Design exercises	30%
Background Research for Design Project	20%
Participation	10%

### Grading Scale

94-100%	A	Excellent
90-93%	A-	
87-89%	B+	
84-86%	B	Above Average
80-83%	B-	
77-79%	C+	
74-76%	C	Average
70-73%	C-	
67-69%	D+	
64-66%	D	Below Average
below 64	F	Fail

### **Expectations and Policies**

- Show up prepared. Be on time, have your readings completed and points in mind for discussion or clarification. Complying with these elements raises the level of class discussion for everyone.
- Have assignments completed on schedule, printed, and done accordingly to the specified requirements. This will help ensure that your assignments are returned in a timely manner.
- Ask questions in class. Engage the lecturer. These are often very busy professionals who are doing us an honor by coming to speak....
- Comply with academic integrity policies (no plagiarism or cheating, nothing unethical).
- Respect differences of opinion (classmates', lecturers, local constituents engaged with on the visits). You are not expected to agree with everything you hear, but you are expected to listen across difference and consider other perspectives with respect.

**Please refer to the SIT Study Abroad Student Handbook** for policies on academic integrity, ethics, warning and probation, diversity and disability, sexual harassment, and the academic appeals process.

**Disability Services:** Students with disabilities are encouraged to contact Disability Services at [disabilityservices@sit.edu](mailto:disabilityservices@sit.edu) for information and support in facilitating an accessible educational experience. Additional information regarding SIT Disability Services, including a link to the online request form, can be found on the Disability Services website at <http://studyabroad.sit.edu/disabilityservices>.