42611 Theory of science in engineering

Introduction

Today’s program

9-10: Introduction to the course

- Presentation, content and the exam
- Practical aspects

10-10.30: Group formation

10.30-16:00: Sustainability

Teachers

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Why Theory of Science in Engineering?

- The historical tradition
  - From Philosophy to a question about education
  - The university educates the experts and they must be broadly educated so that they can live up to their social responsibilities

- A disciplinary/professional understanding
  - You need to know the basic premises of science to participate and use it properly
  - What is knowledge, truth, the methods of science and the responsibility and ethics of science?
  - In a complex knowledge society with specialisation, one needs to be aware of context and other forms of knowledge in order to achieve holistic orientation

- A sociological explanation
  - University and science are part of society
  - If engineers are to be effective in society, they must know the context of science and the framework in which technology and engineering knowledge must be applied

An institutional/organisational rationale

‘In response to the global climate challenge and the accelerating depletion of the Earth’s resources, we strive for a sustainable future by developing technology for people. We lead the drive for sustainable change and realize the opportunities offered by digitalization, through innovation and cutting-edge research for the benefit of society.’

DTU has decided that the subject's theory of science should be combined with basic knowledge of sustainability assessment and considerations of 'technology for people'

General course objectives

The aim of the course is to provide the students with the ability to understand, apply and assess:

1. Issues from the theory of science involving technology and engineering.
2. The relation between engineering and its scientific, societal and environmental context.
3. Values in engineering, and the sustainability impacts of engineering.

1. Theoretical problems of science involving technology and engineering

- **Ontology** - what is it in the world we are investigating?
  - For engineers, it's nature and the physical world
  - For social sciences it is the social world, e.g. democracy, economy, organisation..
  - For the humanities, it is ideas, meaning-making, narratives...

- **Epistemology** - how do we investigate what we are interested in and what can we know about it?
  - For engineers, it is largely observations of the physical world that can lead to quantitative descriptions of measurable quantities and relationships and to models and predictions
  - Ideal of independence between the subject (the investigator) and the object (what is being investigated)

2. The relationship of the engineering discipline to its scientific, historical, social and environmental context

- Technological science and technology do not exist in a vacuum, but are part of many different contexts
- Engineering differs in some respects from other scientific contexts by being more focused on practical application, innovation and intervention - and even more from social and human sciences knowledge
- In the past, engineering was largely oriented towards society's many infrastructures, but in recent decades there has been an increasing focus on innovation and commercialization
- Technology must not only be technically effective, it must also be economically efficient and socially legitimate to work for the good of society
- Technology must be developed, deployed and used within the overall environmental and resource framework

3. Values in engineering, and the environmental, economic and social consequences of engineering

- Fundamental values in engineering are truth, efficiency, objectivity, control, rationality, quantifiability ...
- Values can be so fundamental that they are unconscious
  – e.g. more research/technology is good
- Some values may have divergent interpretations - e.g. rationality
- Engineering values are not necessarily shared by all others in society

- We use the SDGs as the overarching value map
- The values expressed in the SDGs may be in conflict with each other and dilemmas and trade-offs may arise

- Life cycle assessment is a way to relate concretely to values and make them quantifiable

Course contents

- Days 1-5 on sustainability focus on giving you content and working with the central task of a sustainability case
  - You will hand in 2 assignments during these days

- Days 6-9 focus on providing you with key concepts and theories from the theory of science
  - Each day you hand in an assignment, which usually consists of two parts

- Days 10-15 focus on giving you key concepts and theories from science theory about science in society
  - Each day you hand in an assignment, which usually consists of two parts
  - Some assignments are based on self-selected examples

About the exam

- Active participation in the lectures is the means to achieve the learning outcomes
  - But attendance is not compulsory
  - The idea is that you do the assignments in the time allocated for group work
- The exam is a portfolio exam where you have to hand in and pass all 12 assignments during the 3 weeks
  - The grade is pass/fail
  - Assignments are group work - you must indicate who has done what or that you have all done it together
- Assignments must be handed in by the deadlines set
  - If an assignment is not passed, it must be handed in again within 2 weeks of the last day of the course
  - In weeks 2 and 3 we aim to approve assignments handed in on time the next day

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