3.2.l Course Module on 2nd Semester: Optimisation Theory and Modern Reliability from a practical approach

Title:
M2-13 Optimisation Theory and Modern Reliability from a practical approach / Optimeringsteori og moderne pålidelighedsteori set fra et praktisk synspunkt

Prerequisites:
Mathematical courses on the Bachelor of Energy Engineering and the course in Mathematics and English on 1st semester of Master of Science studies in Energy Engineering or similar.

Objective:
Students who complete the module should:

Knowledge:

- Have comprehension of the fundamental concepts, terms and typical methods used within numerical optimisation of stationary linear and non-linear optimisation problems
- Have comprehension of the fundamental concepts, terms and methods used within optimisation of (dynamic) optimal control problems
- Have gained an in-depth understanding of important concepts and methods of optimisation for efficient solution of optimisation problems within different areas of engineering
- Have comprehension for how to apply reliability and robust design approach during product development.
- Understand statistics that support Robustness, Reliability and Lifetime and Outdated reliability practices.
- Be able to quantify Cost of Poor Quality in a product life-time
- Be able to establish Mission profile for different applications and use it into the useful reliability context
- Understand difference between preventive scheduled maintenance or by degradation
- Have comprehension for stressor components like temperature, humidity, vibration and their impact.
- Understand life time modelling of components
- Understand in physics of failure approach and also failure mechanism – both in normal operation and beyond operating in the Safe Operating Area.
- Get knowledge about qualitative and quantitative test methods for reliability assessment.
- Get knowledge about prognostic methods and real-time monitoring in power electronic systems

Skills:

- Be able to use optimisation concepts and topics
- Be able to use numerical methods of unconstrained optimisation.
- Be able to use numerical (mathematical programming) methods for optimisation of multi-dimensional functions with constraints.
- Be able to solve multi-criterion optimisation problems
- Be able understand how designs fits into the Robustness Validation concept
- Be able to set up simple methods for reliability targets and field analysis.
- Be able to set up lifetime requirement at function level or component level.
- How to use test methods for reliability and robustness assessment.

Competence

- Be able to account for the considerations involved in the process of formulating and modelling stochastic processes and engineering optimisation problems, choosing an advantageous method of solution, and implementing it in practice.
- Be able to analyse functions, design them robust and also be able to quantify the reliability of the functions
- Be able to build a system reliability model.
- Set up thermal design limits for power electronic product
- Be able to specify test procedures for new product development

Type of instruction:
The form(s) of teaching will be determined and described in connection with the planning of the semester. The description will account for the form(s) of teaching and may be accompanied by an elaboration of the roles of the participants (see chapter 3).

Form of examination:
Internal written examination in accordance with the rules in the Examination Policies and Procedures, Addendum to the Framework Provision of Faculty of Engineering and Science, Aalborg University.

Evaluation criteria:
As stated in the Framework Provisions