Ph.D. Qualifying Exam: Design

Department of Mechanical Engineering University of Utah

Exam Description:

This qualifying exam will test the student's undergraduate-level knowledge of the design of mechanical elements. The exam is designed to assess the candidate's knowledge and approach to solving problems involving fundamental ideas pertinent to designing various mechanical components. Students are expected to apply basic science principles, including statistics and tolerances, to engineering design problems. Specifically, students should be able to calculate and design mechanical elements such as bolted and welded joints and shafts under static and/or fatigue loading situations using the principles of material strength and solid mechanics.

Recommended References:

- Raeymaekers' Design of Mechanical Elements, Wiley (1st Ed.)
- Shigley's Mechanical Engineering Design, Budynas & Nisbett (10th Ed.)

Exam Materials:

Equation sheets will be provided to students for their preparation before the exam. The same sheet will be provided with the exam. Students need to bring a department issued calculator. No other materials will be allowed during the exam.

Topics:

The following table provides a list of topics that could be asked on the exam, along with the corresponding sections in the reference textbooks.

- Part 1: Introduction to mechanical design (design factor)
- Part 2: Statistical considerations
- Part 3: Tolerance
- Part 4: Material selection (Cold-work)
- Part 5: Design for static strength
- Part 6: Design for fatigue strength
- Part 7: Design of shafts
- Part 8: Design of bolted joints
- Part 9: Design of welded joints