



Ph.D. Qualifying Exam: Thermodynamics

Department of Mechanical Engineering University of Utah

Exam Description:

This qualifying exam will test the student's graduate-level knowledge of thermodynamics. Topics will include equilibrium thermodynamics, availability analysis, equations of state, thermodynamic property relations, mixtures, multiphase-multicomponent systems, combustion reactions and availability and statistical thermodynamics.

Recommended Reference:

Thermodynamics: An Engineering Approach, 8th Edition, Y.A. Cengel and M.A. Boles, ISBN: 978007339817.

Exam Materials:

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

Topics:

Thermodynamic systems analysis using:

- First Law/Energy balance
- Second law/Entropy balance
- Exergy/available work
- Maxwell relations
- Clapeyron equation
- Gibbs free energy

Contemporary sustainability issues related to mixtures, multiphase- multicomponent systems, combustion reactions; such as economic, social, and environmental impacts.

Design-related analysis on specific engineering components for energy systems such as:

- Gas power cycles
- Vapor power cycles
- Refrigeration
- Combustion heating
- Energy storage devices

including mixtures, multiphase, and multicomponent systems.

Design refers to the process in which analysis, iteration, judgment, and engineering fundamentals are used to make choices between different engineering parameters such as geometry characteristics, flow rates, energy capacities, and second law compatibility to meet specific performance and operation requirements, or other outside limitations.