# ELEC-E8712 Design for Reliability (5 cr)
2nd Intermediate exam 28.10.2021

1. Answer to following HALT (Highly Accelerated Life Testing) related questions:
   a) What are the typical main objectives for HALT? (1p)
   b) Explain, how the operational limits (OL) and destruction limits (DL) of the product are defined in the step-stress test stages. In addition, describe how these values are used in consecutive stages in conventional (temperature + vibration) HALT process. (2p)
   c) With the help of the picture below, please explain how the OL and DL can be used in screening purposes (for example HASS, Highly Accelerated Stress Screening) and what kind of challenges there are related to defining the correct stress level in stress screening? (2p)
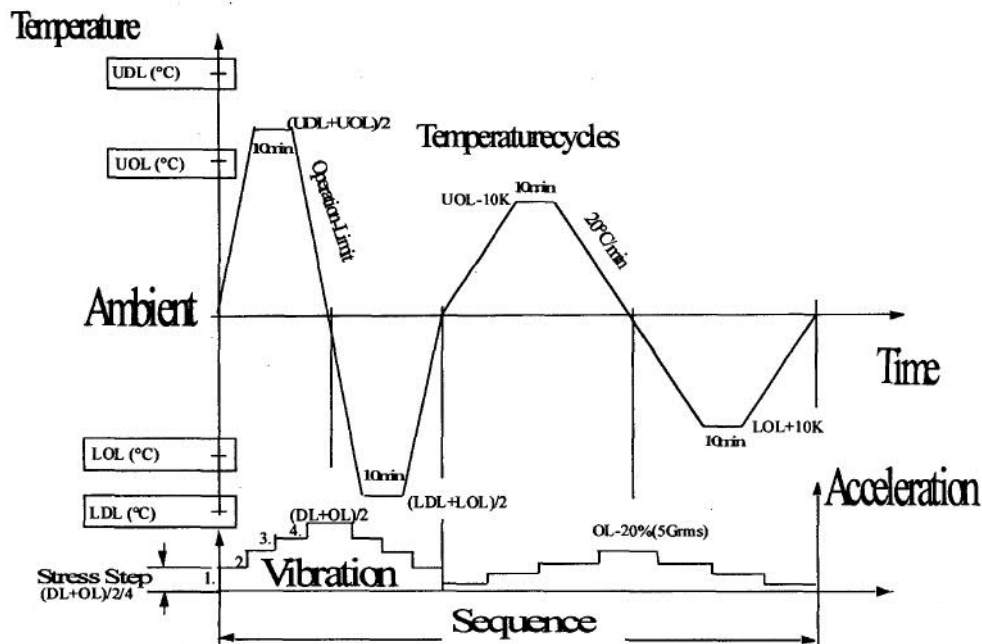
2. a) Related to environmental testing, please explain the difference between "saturated" and "unsaturated" humidity testing conditions. In addition, describe how the "saturated" and "unsaturated" T>100°C testing conditions are achieved. (2p)
   b) Discuss briefly on the challenges related to accelerated corrosion testing methods. (2p)

3. Your responsibility as a reliability engineer is to verify the operational and long-term reliability of a LiDAR (see next page for details) based positioning system for autonomously navigating ship. As a part of this task you need to design an ALT (Accelerated Life/ Reliability Testing) practice for MEMS μ-mirror, which one of the key components in the LiDAR system. Discuss on the design, assumptions and challenges related to ALT methodology for this specific component. (5p)
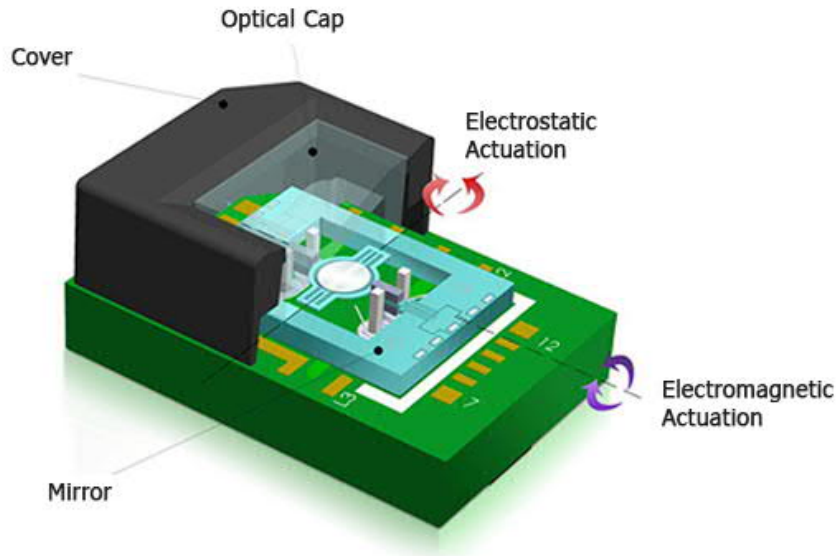
Figure: MEMS μ-mirror component

LiDAR is a method for measuring distances (ranging) by illuminating the target with laser light and measuring the reflection with a sensor. Differences in laser return times and wavelengths can then be used to make digital 3-D representations of the target.