Reliability
Component and system reliability

Fracture mechanics
Read fractured surfaces

Corrosion and diffusion
Degradation by corrosion and diffusion

Fatigue fracture
Infinite life and safe life design

Contact mechanics
Load rating of concentrated contacts

Friction
Physics of friction and how to manage

Wear
Wear mechanisms and how to manage

Matselect
Material selection for rolling and sliding contacts

Lubselect
Lubricant selection for rolling and sliding contacts
Hydrodynamic lubrication
Sealing systems

Advanced Engineering Design

Lifetime performance and reliability

Day program 1 & 2

Module	- Learning objectives: After this module you should be able to	Keywords
Reliability	- quantify component and system reliability - apply design procedures to optimize system reliability.	Component and system reliability, standard normal distribution, probability density, maintenance versus reliability, redundancy, fault tree analysis, critical path, FMEA
Fracture mechanisms	- Identify ductile-, brittle- and fatigue fracture - Read fractured surfaces	Applied stresses, complementary stresses, shear failure, tensile failure, fatigue stages, beach marks, striations, ratchet marks
Corrosion & diffusion	- Identify corrosion mechanisms and apply related corrective measures.	Galvanic-, pitting-, crevice,- , microbial-, stress-, fatigue corrosion, hydrogen embrittlement, quench cracking. Galvanic Passive-, active and self-healing coatings. Cathodic protection.
Fatigue fracture	- design reliable dynamically loaded screw joints. - drive shafts loaded in rotational bending and torsion. - design dynamically loaded welded connections.	Joint stiffness, potential failure mechanisms, thermo-mechanical fatigue, infinite life design, safe life design, fail safe design, damage tolerant design, accelerated testing, SN diagram, endurance limit, safe stress design, rotary beam test, fatigue life models, influence factors, stress concentrations, streamlining of stresses, Palmgren Miner Rule, rain-flow counting, Eurocode 3
Contact mechanics	- quantify the load rating of concentrated contacts and understand related failure modes and mechanisms.	Hertz, elastic deflection, plastic indentation, running in, ratcheting, elastic shakedown, contact stiffness, (sub)surface initiated fatigue, flaking, spalling, pitting, rolling with traction, vibrations, static load rating, dynamic load rating, subsurface stresses, rolling friction, Reynolds slip, Heathcote slip, spinning, EHL, preload

Advanced Engineering Design

Lifetime performance and reliability

Day program 3 & 4

Module	- Learning objectives: After this module you should be able to	Keywords
Friction	- clarify Coulombs friction and its exceptions. - manage friction	Real contact area, surface chemistry, surface energy, surface topography, characterization, superfinishing, contact conditions, environment, vacuum, temperature effect, oxide layer, ploughing, adhesion, atomic bonding, stick, Abbott bearing area, elastic recovery, plasticity index, polymers, ceramics
Wear	- identify wear mechanisms - calculate the wear rate - manage the wear rate of machine components.	Abrasive wear, adhesive wear, corrosive wear, fretting, false Brinelling, galling, cold welding, seizure, flash temperature, scuffing, ratcheting, particle erosion, electro chemical erosion, Archard's equation, wear rate, non-stationary contact, running in, testing, test conditions
Matselect	- find solutions for wear related failures - select the best material combinations and coatings.	Systematic selection, divergent thinking, coatings, kolsterizing, carburizing, squeaking, stick-slip, several case studies, thread galling, solid lubricants, MoS2, graphite, self-lubricating polymers, ceramics, HVOF
Lubselect	- identify lubrication regimes - clarify seizure load - categorize lubricants and performance additives - select the best lubricant.	Stribeck curve, boundary lubrication, mixed lubrication, running-in, base oils, synthetic lubricants, viscosity index improvers, boundary lubricant additives, lubricant life additives, engine oils, fuel efficiency, compounded oils, food grade lubricants, environmental compatible, compatibility with polymers and elastomers, testing, stress cracking, swelling, shrinking, greases, trends and innovations
Sealing systems	- identify possible failure mechanisms - manage performance limitations	Low pressure lip seals, high pressure sealing systems, modelling of lubrication regimes.