CONTENT
MASTER MECHANICAL ENGINEERING

- What is Mechanical Engineering
- ME master program at UT
  - Competences (Tracks)
  - Specialisations
- Overview of specialisations
- Admission
  - HBO WB
  - BSc UT
- Information on specialisations (market NH 124)
WHAT IS MECHANICAL ENGINEERING?
WHAT IS MECHANICAL ENGINEERING?
A BROAD DISCIPLINE

Large structures
Aeropace
3D Printing
Maintenance
Consumer products
WHAT IS MECHANICAL ENGINEERING?
A BROAD DISCIPLINE

Composite structures
(Sustainable energy
(Bio-)Robotics
Automotive

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DESIGN CYCLE

Analysis and description of design problem

Definition of the design requirements

Conceptual designs

Prototype

(Detailed) design

Test and evaluation of design
DRONE
BENIFITS OF A DRONE FOR COMMUNITY

- Support for disaster management;
- Rescue of people in mountains;
- Post delivery
- ........
WHAT ARE MECHANICAL ASPECTS OF A DRONE?

- Propulsion
- Vibrations
- Stability of a camera
- Strength
- Fatigue
- Aerodynamics
- Control
ROLE OF MECHANICAL ENGINEER

Combination of several aspects:
- Design, production but also maintenance
- Life Cycle/Sustainability
- What is possible?
- Is this what people want?
- What does it cost?

Dealing with concessions
DIFFERENCE BETWEEN HBO AND WO

- Mechanical Engineering same discipline, BUT

**HBO:**
- Practice / Industry
- How?
- Less abstract

**WO:**
- Scientific / Research
- Why?
- More fundamental (theory)

Higher teaching speed
MECHANICAL ENGINEERING
AT THE UNIVERSITY OF TWENTE
MECHANICAL ENGINEERING MSc PROGRAM

1st year

Profile courses
25 EC

Specialisation courses
15-20 EC

Elective courses (10-15)

In depth (0-10)

2nd year

Internship
20 EC

Thesis
40 EC
MECHANICAL ENGINEERING MSC PROGRAM
COMPETENCE PROFILES & SPECIALISATIONS

- Three competence profiles (Tracks)
  - Research & Development
  - Design & Construction
  - Organization & Management

- Five specialisations
  - Biomechanical Engineering & Biorobotics
  - Design Production & Management
  - Maintenance Engineering & Operations
  - Mechanics of Solids, Surfaces & Systems
  - Thermal & Fluids Engineering

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MECHANICAL ENGINEERING MSC PROGRAM
COMPETENCE PROFILES

- What kind of work do I like?
  - Researcher
  - Designer
  - Organizer

- What are my strong points?
  - Fundamentals, analyzing, doing experiments, communication, creativity, organization, .....

- Where would I like to have a job?
You have to specialise in a specific area in the field of ME in order to expand the borders of the subject of your master assignment.

Which field of Mechanical Engineering do I like / am I interested in?

Disciplines like
- Mechanics, Fluid dynamics, Energy Technology, Tribology, Materials, Design, Production, Maintenance, ……

Application areas like
- Acoustics, Robotics, Gas turbines, Rehabilitation, Aerospace, Automotive, Virtual Reality, Composite/light weight structures, ….
<table>
<thead>
<tr>
<th>Competence Profiles &amp; Specialisations</th>
<th>Researcher (R&amp;D)</th>
<th>Designer (D&amp;C)</th>
<th>Organisor (O&amp;M)</th>
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</thead>
<tbody>
<tr>
<td><strong>Mechanics of Solids, Surfaces &amp; Systems (MS3)</strong></td>
<td>✓</td>
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<tr>
<td>Applied Mechanics (AM)</td>
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<td>Elastomere Technology (ETE)</td>
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<td>Mechanical, Automation and Mechatronics (MA)</td>
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<td>Production Technology (PT)</td>
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<td>Surface Techn. &amp; Tribology (STT)</td>
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<td>Design Engineering (DE)</td>
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<tr>
<td>Production Management (PM)</td>
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<tr>
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<td>Engineering Fluid Mechanics</td>
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<td>Multi Scale Mechanics</td>
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<tr>
<td>Thermal Engineering</td>
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<tr>
<td><strong>Biomechanical Engineering (BE) &amp; BioRobotics</strong></td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td><strong>Maintenance Engineering &amp; Operations (MEO)</strong></td>
<td>✓</td>
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</tbody>
</table>
MECHANICAL ENGINEERING MSC PROGRAM
PROFILE COURSES

Research & Development:

These courses are fundamental courses that provides information on theoretical aspects of the matter necessary to analyze products and processes and they provide tools to develop and optimize them

- Fluid Mechanics
- Transport Phenomena
- Linear Solid Mechanics
- Solids and Surfaces
- System Identification & Parameter Estimation
- Numerical Methods in Mechanical Engineering
MECHANICAL ENGINEERING MSC PROGRAM
PROFILE COURSES

Design & Construction:

These courses focus on design of products and processes at different levels (micro / macro) and in different disciplines

- Design of Biomedical Products
- Product Design
- Process Equipment Design
- Design, Production & Materials
- Design Principles of Precision Mechanisms
- Numerical Methods in Mechanical Engineering
MECHANICAL ENGINEERING MSC PROGRAM
PROFILE COURSES

Organisation & Management:

These courses treat themes in the field of organization and management of processes like, logistics, factory layout, product routing and maintenance of products, machines and constructions

- Maintenance Engineering & Management
- Manufacturing Facility Design
- Design of Production and Inventory Systems
- Engineering Project Management
- Cost Management and Engineering
MECHANICAL ENGINEERING MSC PROGRAM
SPECIALISATIONS
BIOMECHANICAL ENGINEERING & BIOROBOTICS

Focuses on the use of mechanical engineering technology and methodology to address health care problems

Core courses:
- Biomechanics
- Human Movement Control
- Design of Biomedical Products
- Biomechatronics

Working area:
- Design of medical equipment (diagnostic devices)
- Design of appliances for compensation of failing physical functions (prostheses/ortheses)
DESIGN, PRODUCTION AND MANAGEMENT

DESIGN ENGINEERING

Focuses on design technology, production/manufacture or management of production and logistics.

Core courses:
- Design Tools
- Life Cycle Strategy
- Manufacturing Facility Design
- CAD/CAM 3

Working area:
- Improvement of design process
- Software development to encourage creative process
- Use of Virtual Reality

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**Design, Production and Management**

**Production Management**

*Looks at time efficiency, the highest quality and the lowest possible cost in addition to a specialist knowledge of technology*

**Core courses:**
- Discrete Optimization of Business processes
- Warehousing
- Simulation
- Stochastic Modelling for Operations Management
- Supply Chain and Transport Management

**Working area:**
- Logistics within company, Production logistics
- Factory lay-out, Capacity planning
- Stock lay-out & management

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THERMAL AND FLUIDS ENGINEERING

Focuses on the theoretical, numerical and experimental aspects of gasses and fluids and their thermal behavior

Core courses:
- Advanced Engineering Thermodynamics
- Energy Conversion Technology
- Computational Fluid Dynamics
- Multiphase Flows

Assignment specialisations
- Engineering Fluid Mechanics
- Thermal Mechanical Engineering
- Multi Scale Mechanics

UNIVERSITY OF TWENTE.
THERMAL AND FLUIDS ENGINEERING

Focuses on the theoretical, numerical and experimental aspects of gasses and fluids and their thermal behavior

Working area:
- Education (University) and Research
- Research Institutes (NLR, MARIN, TNO)
- Industry (Phillips, Siemens, Wartsila, Exxon, Shell, Boskalis, Nestle, Bayer, Shell, TNO, Alstom, Rolls-Royce, Siemens, Sulzer, etc.)
MAINTENANCE ENGINEERING & OPERATIONS

Design and improvement of maintenance and logistic support for the complete life cycle of technical equipment

Core courses:
- Maintenance Engineering & Management
- Reliability Engineering & Maintenance Management
- Structural Health & Condition Monitoring
- Failure Mechanisms & Life Prediction

Assignment specialisations
- Maintenance Engineering
- Dynamics Based Maintenance
- Tribology Based Maintenance
MAINTENANCE ENGINEERING & OPERATIONS

Design and improvement of maintenance and logistic support for the complete life cycle of technical equipment

Working area:
- Multi disciplinary: technology, organisation and finance
- Requires: analytical competences, technical system knowledge and management skills.
- Industry: Tata steel, Nedtrain, Prorail, Thales, Imtech, KLM, ……

Maintenance Engineer, Asset Engineer, Reliability Engineer and Safety Engineer

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Mechanics of Solids, Surfaces & Systems  MS$^3$

Develops the technology for future manufacturing processes and new products by a science based engineering approach focused on material- and system behavior and robust optimization

Core courses:

- Computational structural optimization
- Dynamics & Control
- Nonlinear Solid Mechanics
- Plastic & Elastomer Engineering
- Experimental Methods

UNIVERSITY OF TWENTE.
Mechanics of Solids, Surfaces & Systems  MS³

Develops the technology for future manufacturing processes and new products by a science based engineering approach focused on material- and system behavior and robust optimization

Assignment specialisations:

- Applied Laser Technology
- Design of Mechanisms and Robotics
- Elastomer Technology and Engineering
- Mechanical Automation & Mechatronics
- Nonlinear Mechanics
- Production Technology (Composites & Smart Fibres)
- Skin Tribology
- Structural Dynamics & Acoustics
- Surface Technology and Tribology

UNIVERSITY OF TWENTE.
Mechanics of Solids, Surfaces & Systems $\text{MS}^3$

Develops the technology for future manufacturing processes and new products by a science based engineering approach focused on material- and system behavior and robust optimization

Working area:

- Education (University) and Research
- Research Institutes (NLR, TNO)
- Automotive, Aerospace, Off-shore Industry
- ASML, Philips, Demcon, VDL, Vredestein, .....

UNIVERSITY OF TWENTE.
BEING
MSC IN MECHANICAL ENGINEERING
TO INDUSTRY OR INSTITUTE OR …?
OR

Broaden your knowledge

- 4 year PhD
- 2 year PDEng
- 2 year MSc
- 3 year BSc
BSc ME is directly admitted (UT, TUD, TU/E)

BSc other technical studies
- Some pre-master courses and/or
- Obligatory BSc courses within the master and/or
- Obligatory MSc courses combined with self study of missing
  BSc knowledge

http://www.utwente.nl/en/education/master/how-to-apply/
ADMISSION
HBO PRE-MASTERS

- Top student at HBO
- Mathematics / Physics / English at VWO level
- Average grade for relevant courses $\geq 7.5$

- Finalised HBO-program in related program or during minor at HBO (Academic minor / ‘Doorstroomminor’)
  - 30 ec pre-master courses as pre-master or minor
  - Obligatory BSc courses within the master in stead of internship

- Pre-master is for basic academic knowledge of mechanical engineering and satisfactory for admission for all master specialisations

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ME PRE-MASTER PROGRAM
FOR HBO
Pre-master program is selection of courses from bachelor program ME (30 + 18 ec)

- A lot of mathematics → special for hbo’ers
- Academic Research Skills → special for hbo’ers
- Extending basic knowledge
  - Thermo dynamics, fluid mechanics, heat exchange, control, dynamics, mechanics→ together with ME-bachelors
- Possibly individual adaptations
# OBLIGATORY COURSES PRE-MASTER PROGRAM ME

**HBO WB**

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<tr>
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<tr>
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After two Quarts: All courses ≥ 5.5 → Admission for Master UNIVERSITY OF TWENTE.

During master in stead of internship.
ADMISSION FOR OTHER UT BSC PROGRAMS
ADMISSION FOR OTHER UT BSC PROGRAMS
ADVANCED TECHNOLOGY

AT

- Minor **Biorobotics** (Q1, 15 EC)
- Minor **Aircraft Engineering** (Q2, 15 EC)
- Heat Transfer (Q3, 3.5 EC)
- Fluid Mechanics 1 (Q3, 3.5 EC)
- Introduction to Finite Element Method (Q3, 3.5 EC)
- Dynamics 2 (Q4, 4.5 EC)
- Obligatory courses during master
  - Introduction to ME (Q1/Q3, selfstudy, 4 EC)

UNIVERSITY OF TWENTE.
BMT

- Minor **Biorobotics** (Q1, 15 EC)
- Minor **Aircraft Engineering** (Q2, 15 EC)
- Heat Transfer (Q3, 3.5 EC)
- Introduction to Finite Element Method (Q3, 3.5 EC)
- Introduction to ME (Q3, selfstudy, 4 EC)
- Dynamics 2 (Q4, 4.5 EC)
- Obligatory courses during master
  - Fluid Mechanics 2 (if TFE) with Fluid Mechanics 1 self study
ADMISSION FOR OTHER UT BSC PROGRAMS
CIVIL ENGINEERING

CiT

- ME Module 5 **Dynamic Systems** with Programming in Engineering (PIE) in stead of Math D2 (Q1, 15 EC)
- Minor **Aircraft Engineering** with Technical Thermodynamics 1 in stead of Introduction on Aircraft Technology (Q2, 15 EC),
- Obligatory courses during master in stead of internship
  - Numerical Methods in Mechanical Engineering with Introduction to Finite Element Method as self study
  - Heat Transfer (Q3, 3.5 EC)
  - Dynamics 2 (Q4, 4.5 EC)
  - System & Control (Q4, 3.5 EC)
  - Technical Thermodynamics 2 (if TFE, Q3, 1.5 EC)
  - Fluid Mechanics 2 with Fluid Mechanics 1 as self study (if TFE)
ADMISSION FOR OTHER UT BSC PROGRAMS
INDUSTRIAL DESIGN

IO

- ME Module 5 **Dynamic Systems** with Programming in Engineering (PiE) in stead of Dynamics 1 (Q1, 15 EC) and Math D1 selfstudy
- Minor **Aircraft Engineering** with Technical Thermodynamics 1 in stead of Introduction on Aircraft Technology (Q2, 15 EC),
- Obligatory courses during master in stead of internship
  - Fluid Mechanics 1 (Q3, 3.5 EC),
  - Numerical Methods in Mechanical Engineering with Introduction to Finite Element Method as self study.
  - Dynamics 2 (Q4, 4.5 EC)
  - System & Control (Q4, 3.5 EC)
  - Technical Thermodynamics 2 (if TFE, Q3, 1.5 EC)
ADMISSION FOR OTHER UT BSC PROGRAMS
TECHNICAL PHYSICS

TN

- Introduction to ME (selfstudy, 4 EC),
- Minor Biorobotics
- ME Module 6 Product Design
- Obligatory courses during master
  - Numerical Methods in Mechanical Engineering with Introduction to Finite Element Method as self study.
  - Dynamics & Control with Dynamics 2 as self study
ADMISSION FOR OTHER UT BSC PROGRAMS
ELECTRICAL ENGINEERING

EE

- ME Module 1 ME Design & Production with Dynamics 1 in stead of Math A+B1
- Minor Aircraft Engineering with Technical Thermodynamics 1 in stead of Introduction on Aircraft Technology (Q2, 15 EC),
- Obligatory courses during master
  - Numerical Methods in Mechanical Engineering with Introduction to Finite Element Method as self study.
  - Dynamics & Control with Dynamics 2 as self study
  - Fluid Mechanics 2 with Fluid Mechanics 1 as self study
  - Heat Transfer

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QUESTIONS?

Dr. Genie Stoffels
Bachelorcoordinator-WB@utwente.nl

Prof.dr.ir. André de Boer
a.deboer@utwente.nl

Websites:
www.utwente.nl/en/education/master/programmes/mechanical-engineering/
www.utwente.nl/ME
www.utwente.nl/ME/premaster

Course information

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QUESTIONS?
SPECIALISATIONS ON THE MARKET

- Mechanics of Solids, Surfaces & Systems (Prof.dr.ir. André de Boer)
- Thermal & Fluids Engineering (Prof.dr.ir. Kees Venner)
- Maintenance Engineering & Operations (Dr.ir. Richard Loendersloot)
- Biomechanical Engineering & Biorobotics (Prof.dr.ir Bart Koopman)
- Design Production & Management (Dr.ir Wessel Wits)