Welcome at the TU/e Graduate School Event

Presentation Mechanical Engineering - Hans Kuerten and Jesse van Kempen
Top-ranking Dutch university

The Netherlands  Brainport  Eindhoven

At the heart of the Brainport region

Strong technology heritage in Eindhoven

Accounts for 22% of total Dutch private R&D expenditure*

Student growth

<table>
<thead>
<tr>
<th>Year</th>
<th>BSc</th>
<th>MSc</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>5,072</td>
<td>3,334</td>
<td>8,406</td>
</tr>
<tr>
<td>2017</td>
<td>7,116</td>
<td>4,179</td>
<td>11,295</td>
</tr>
</tbody>
</table>

Facts and figures are based on the year 2017

Engineers for the future

More than 80 nationalities 11,295 total number of students (+38% compared to 2012)

- 88% Dutch
- 12% International

95% of the graduated students finds a job within 6 months

2,697 total degrees awarded
1,067 BSc / 1,310 MSc
108 PDEng / 212 PhD

41,906 Alumni
- 83% Male
- 17% Female

* in 2015
The TU/e campus covers an area of 75 hectares

**Ecosystem and characteristics**
- Ultra-modern cleanroom
- 11 Knowledge institutes
- 91 Patents
- 3,379 Scientific publications
- Living labs
- 5 New start-ups and spin-offs
- 14 Large research labs
- 50 Smaller research facilities

**International working environment**
- 3,221 Total staff (fte)
- 1,854 Research staff (fte)
- 66% Dutch
- 34% International
- 63% Male
- 37% Female
- 142 Full professors
- 130 Part time professors
- 135 Associate professors
- 293 Assistant professors
- 1,534 PhD fellows
Why TU/e?

• High Tech Campus
  - Signify (Philips Lighting) and Healthcare
  - Solliance PV solar energy
  - SEAC Solar Energy
  - ECN Energy research Center NL
  - NXP semiconductors
• ASML wafersteppers (Veldhoven)
• Océ a Canon company (Venlo)
• VDL Groep
• DAF trucks
• TNO Applied Scientific Research
• TU/e
• Automotive Campus (Helmond)
• FEI High-performance microscopy
TU/e in a nutshell

• High quality research and education
• International network with prominent universities and institutes
• Modern facilities and lab spaces
• TU/e alumni in high demand among employers
• International community with over 80 nationalities
• Friendly, open culture
TU/e in a nutshell

- One campus in city center
- Compact, green
- Modern student facilities
TU/e in a nutshell

- Student associations
- Excellent sport facilities
- Student teams
- Eindhoven – city of design and technology
Mechanical Engineering

• Why Mechanical Engineering (ME) and why TU/e?
• Content of the Master program at ME
• Specializations in the Master
• Experience Jesse van Kempen
• Pre-Master’s program (schakelprogramma)
• Why study at a university?
Why Mechanical Engineering at TU/e?

Best Master’s program
Mechanical Engineering in NL
Keuzegids Masters 2017
Elsevier 2017
Mechanical Engineering

- Why Mechanical Engineering (ME) and why TU/e?
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- Why study at a university?
# Master program MW: overview

2 years, 120 Ecs, English, Master of Science (MSc)

<table>
<thead>
<tr>
<th></th>
<th>Y1</th>
<th>Y2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>20</td>
<td>4 core courses out of 12 core courses offered</td>
</tr>
<tr>
<td>Specialization</td>
<td>20</td>
<td>20 EC out of a total of ~150 EC offered</td>
</tr>
<tr>
<td>Free space</td>
<td>15</td>
<td>Free choice out of all TU/e Master courses offered</td>
</tr>
<tr>
<td>Professional skills</td>
<td>5</td>
<td>2 compulsory modules</td>
</tr>
<tr>
<td>Internship</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Graduation project / Thesis</td>
<td>45</td>
<td></td>
</tr>
</tbody>
</table>

One quartile = 15 EC = 10.5 weeks ≈ 10 weeks
Most courses are 5 EC = 3 courses per quartile
8 weeks courses, 2 weeks exams
Resits in next quartile, only 2 exam possibilities per year
Special master track MSE-W
Manufacturing Systems Engineering

<table>
<thead>
<tr>
<th>Component</th>
<th>EC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>30</td>
</tr>
<tr>
<td>Specialization</td>
<td>15</td>
</tr>
<tr>
<td>Free space</td>
<td>15</td>
</tr>
<tr>
<td>Internship</td>
<td>15</td>
</tr>
<tr>
<td>Graduation project / Thesis</td>
<td>45</td>
</tr>
</tbody>
</table>
# Special master track AIES-W

Artificial Intelligence Engineering Systems

<table>
<thead>
<tr>
<th>Category</th>
<th>Credits (EC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core program</td>
<td>30</td>
</tr>
<tr>
<td>Specialization courses</td>
<td>10</td>
</tr>
<tr>
<td>Professional Skills</td>
<td>10</td>
</tr>
<tr>
<td>Free Electives</td>
<td>10</td>
</tr>
<tr>
<td>Internship</td>
<td>15</td>
</tr>
<tr>
<td>Graduation Project</td>
<td>45</td>
</tr>
</tbody>
</table>
### Core courses 30 EC

**Mathematics 5 EC, choose one**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer</th>
<th>Section</th>
<th>Slot</th>
<th>EC</th>
<th>Quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>5CTA0</td>
<td>Statistical signal processing</td>
<td>Turco</td>
<td>EE</td>
<td>A</td>
<td>5</td>
<td>Q1</td>
</tr>
<tr>
<td>2DME20</td>
<td>Non-linear optimization</td>
<td>Keijsper</td>
<td>W&amp;I</td>
<td>C</td>
<td>5</td>
<td>Q1</td>
</tr>
<tr>
<td>2DME10</td>
<td>Discrete mathematics</td>
<td>Cuypers</td>
<td>W&amp;I</td>
<td>B</td>
<td>5</td>
<td>Q1</td>
</tr>
</tbody>
</table>

### Fundamentals for engineering systems 10 EC, choose two from different categories

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer</th>
<th>Section</th>
<th>Slot</th>
<th>EC</th>
<th>Quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>4CM00</td>
<td>Control Engineering</td>
<td>Witvoet</td>
<td>CST</td>
<td>C/E</td>
<td>5</td>
<td>Q1/Q3</td>
</tr>
<tr>
<td>4CM10</td>
<td>System Theory for Control</td>
<td>Heemels</td>
<td>CST</td>
<td>B</td>
<td>5</td>
<td>Q1</td>
</tr>
<tr>
<td>5SMA0</td>
<td>Control principles for engineered systems</td>
<td>Ozkan</td>
<td>EE</td>
<td>D1</td>
<td>5</td>
<td>Q2</td>
</tr>
<tr>
<td>4DM20</td>
<td>Engineering optimization</td>
<td>Etman</td>
<td>DC</td>
<td>B</td>
<td>5</td>
<td>Q3</td>
</tr>
<tr>
<td>2DME20</td>
<td>Nonlinear Optimization</td>
<td>Keijsper</td>
<td>W&amp;I</td>
<td>C</td>
<td>5</td>
<td>Q2</td>
</tr>
<tr>
<td>4AI000</td>
<td>Machine learning for modelling and design</td>
<td>Lopez</td>
<td>DC</td>
<td>A</td>
<td>5</td>
<td>Q4</td>
</tr>
<tr>
<td>4DM10</td>
<td>Multi-body and Nonlinear Dynamics</td>
<td>Van de Wouw</td>
<td>DC</td>
<td>A</td>
<td>5</td>
<td>Q2</td>
</tr>
<tr>
<td>5LIL0</td>
<td>Intelligent architectures</td>
<td>Corporaal</td>
<td>EE</td>
<td>C2</td>
<td>5</td>
<td>Q3</td>
</tr>
</tbody>
</table>

### Human interaction & ethics 5 EC

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer</th>
<th>Section</th>
<th>Slot</th>
<th>EC</th>
<th>Quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>0LSUE0</td>
<td>Rational Agents (Ethics for AI)</td>
<td>Borghuis</td>
<td>EI&amp;IS</td>
<td>A</td>
<td>5</td>
<td>Q2</td>
</tr>
</tbody>
</table>

### Learning AI 10 EC

<table>
<thead>
<tr>
<th>Code</th>
<th>Course name</th>
<th>Lecturer</th>
<th>Section</th>
<th>Slot</th>
<th>EC</th>
<th>Quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>5SLLO</td>
<td>Artificial neural networks and deep learning</td>
<td>Vullings</td>
<td>EE</td>
<td>A2</td>
<td>5</td>
<td>Q4</td>
</tr>
<tr>
<td>5SSDO</td>
<td>Bayesian machine learning and information processing</td>
<td>De Vries</td>
<td>EE</td>
<td>B2</td>
<td>5</td>
<td>Q3</td>
</tr>
<tr>
<td>4WM00</td>
<td>Coaching and tutoring / Teamwork and academic writing</td>
<td>Beks</td>
<td>Wtb</td>
<td>X/D</td>
<td>2.5</td>
<td>Q1/Q2/Q3/Q4/Q2/Q3</td>
</tr>
<tr>
<td>4WM50</td>
<td>Coaching and tutoring / Teamwork and academic writing</td>
<td>Beks</td>
<td>Wtb</td>
<td>X/D</td>
<td>2.5</td>
<td>Q1/Q2/Q3/Q4/Q2/Q3</td>
</tr>
<tr>
<td>4WM10</td>
<td>Career development</td>
<td>Doreleijers</td>
<td>Wtb</td>
<td>X</td>
<td>2.5</td>
<td>Q1/Q2/Q3/Q4/Q2/Q3</td>
</tr>
<tr>
<td>******</td>
<td>Programming for artificial engineering systems</td>
<td>*****</td>
<td>EE</td>
<td>**</td>
<td>5</td>
<td>Q3</td>
</tr>
</tbody>
</table>
Degree program: professional skills

Each student has to pass two courses:

• 4WM00 – Coaching and tutoring (2.5EC)
  (group dynamics, leadership, project planning, ...)
• 4WM10 – Career Development (2.5EC)
  (orientation of future career, assessment, networking, ...)

And one test:

• TU/e Diagnostic Test of Professional Skills (0EC)
  (writing, presentation, teamwork, entrepreneurial, creative, leadership skills)

* HBO and international students take the course 4WM50 Group work and academic writing.
Mechanical Engineering

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# Research clusters

<table>
<thead>
<tr>
<th>Dynamical Systems Design (DSD)</th>
<th>Thermo Fluids Engineering (TFE)</th>
<th>Computational and Experimental Mechanics (CEM)</th>
</tr>
</thead>
</table>

- Each research cluster contains different research sections
- Specializations for MW are the research sections
A research section is the basis for your choice for core and specialization courses, internship, thesis project and possibly your free space.
Dynamical Systems Design

Research sections:

• Control Systems Technology, Prof. M. Steinbuch
• Dynamics and Control, Prof. H. Nijmeijer

Example research areas:

• Automotive Powertrains
• Advanced Motion Systems (Hybrid and Networked Control Systems)
• Robotics for Care and Cure
• Energy Systems
• Acoustics and Noise Control
• Manufacturing Networks
• Cooperative Adaptive Cruise Control
• Vehicle dynamics, tire dynamics and control
Dynamical Systems Design

Cooperative Adaptive Cruise Control

Master-slave, haptic feedback

Wafer stepper

Fusion reactor
Thermo Fluids Engineering

Research sections:
- Power and Flow, Prof. N. Deen
- Energy Technology, Prof. D. Smeulders

Example research areas:
- Efficient Engines
- Multiphase Flows
- Metal Fuels
- Micro-scale Heat Transfer
- Small-scale Renewable Energy Systems
- Heat Storage
Thermo Fluids Engineering

WEDACS

Solar simulator

Metal fuels

PVT combipanels and heat storage
Computational and Experimental Mechanics

Research sections:

• Mechanics of Materials, Prof. M. Geers
• Polymer Technology, Prof. P. Anderson
• Microsystems, Prof. J. den Toonder

Example research areas:

• Mechanics of Micro-Electronics
• Advanced High-Tech Materials
• Materials for Energy

• Applied Rheology and Process Modelling
• Chaotic Mixing and Multiphase Flows

• Micro-Manufacturing Technologies
• Cells and Organs on a Chip
Computational and Experimental Mechanics

Wearable sweat sensor
DAF cylinder heads: micro-crack formation
Novel microactuators for ASML
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Experience Jesse van Kempen

- Bachelor Mechanical Engineering
- Master Mechanical Engineering
  - Energy Technology & Fluid Dynamics
  - Currently graduating
Experience Jesse van Kempen

• Before Master:
  • Visit master-presentations
  • Talk with master-students
  • Look on websites of research groups
  • What courses/projects of the Bachelors did I like most?

• During Master:
  • Smaller groups
  • Field of interest
  • Specialization -> increase knowledge
  • Applicable -> Being prepared for ‘real world challenges’
Graduation Project

- Uncertainty model parameters -> uncertainty of the estimated geothermal power
  - Given specific observations (i.e. real pressure)
  - Deduce information about model parameters (i.e. porosity, permeability)
- Learning from data
Extracurricular activities

- SSCE (Student Sport Centre Eindhoven)
  - ± 70 sports
  - Part-time job: Teaching Assistant
    - Education team
    - Guided selfstudies of master course
  - Student team
    - Organizing events for energy enthusiasts
Student teams
Team Energy
Solar Team Eindhoven
Mechanical Engineering

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Pre-Master’s program for HBO-students

• Program of 30 EC’s
• Starts in September
• Aim of the program
  • Knowledge deficiency, especially mathematics
  • Does academic education suit you?
## Pre-Master’s program 2020-2021

<table>
<thead>
<tr>
<th>Quartile 1</th>
<th>Quartile 2</th>
<th>Quartile 3</th>
<th>Quartile 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculus (5 EC)</td>
<td>Advanced Calculus (2.5 EC)</td>
<td>Solid Mechanics (CEM)</td>
<td></td>
</tr>
<tr>
<td>Linear algebra (2.5 EC)</td>
<td>Dynamics &amp; control of mechanical systems (DSD)</td>
<td>Electives</td>
<td></td>
</tr>
<tr>
<td>Trainings</td>
<td>Thermodynamics (TFE)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.5 EC</td>
<td>12.5 EC</td>
<td>10 or 5 EC</td>
<td>0 or 5 EC</td>
</tr>
</tbody>
</table>

- **Trainings:** Matlab, RSI, safety and environment
- **Compulsory courses of 25 EC, one elective of 5 EC**
- **10 EC for mathematics**
Regulations in the pre-master’s program

• **Binding Study Advice** of 100 % - so 30 EC’s in 1 year
• With good study progress the student can start attending master courses up to a maximum of 15 EC’s
• Yields exemptions in the master
Be prepared

• A pre-master’s program is more work than one might think. You must be willing to work hard.
• It is not advised to do the pre-master in combination with a part-time job in industry.
• Subscription for a pre-master via Studielink before May 1st.
• required minimum level of mathematics: pre-university (VWO) mathematics B or TU/e mathematics B test completed before September 1st
• required minimum level of English proficiency: pre-university (VWO) level English or English language proficiency test completed before September 1st
Admission

• **Direct admission with:**
  
  Mechanical Engineering, Applied Physics, Marine Technology and Aerospace Engineering at university level (WO Werktuigbouwkunde, Technische Natuurkunde, Maritieme Techniek en Lucht- en ruimtevaarttechniek)

• **Admission via pre-master’s program with:**
  
  Mechanical Engineering, Electrical Engineering, Automotive, Applied Physics, Mechatronics, Aerospace Engineering at HBO level (HBO Werktuigbouwkunde, Elektrotechniek, Autotechniek, Technische Natuurkunde, Mechatronica, Luchtvaarttechniek)
  
  Tailor-made pre-master’s programs for other (university + HBO) diplomas via admission committee
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Difference WO and HBO

University of Technology:
- **Developing** new technology and design methods to solve technological problems
- In depth education
- Lecturers are involved in research
- **Internship is a research project**

But also: research in close connection with industry!

University of Applied Science:
- **Applying** existing technology and design methods to solve technological problems
- Education focusses on practical application
- Internship in industry
More information?

Go to the stand in Auditorium

Or contact:

- Academic advisor: Academic.advisor.MMECH@tue.nl
- Educational director: J.G.M.Kuerten@tue.nl
- ME-website: www.tue.nl/mech (info on Master’s program, curriculum, interviews with students and alumni)
APPLICATION MASTER PROGRAMS

For Dutch students:
- More information about admission: www.tue.nl/admission
- Application via http://www.studielink.nl/
- Questions: studeren@tue.nl

For international students:
- Check the requirements for admission via www.tue.nl/admission
- Apply at the online application form (available from 1 Oct – 1 May)
- Application fee of €100 for each application (non refundable)
- Application procedure takes +/- 8 weeks
- You will be informed by email about the outcome of your application
- Questions: io@tue.nl