

Mechanical Engineering

Opto-Mechatronics

MSc Programme



PHOTOGRAPHY BY H. WERIJ, TNO

Opto-mechatronic systems and products are everywhere and some examples are: A wafer scanner writing 10 nm structures using an optical path comprising over 50 optical elements. Or a telescope gathering star light photon-by-photon from the outskirts of the universe. The development of these systems requires understanding and development in subjects such as metrology with picometer accuracy, low-light astronomy, precision 3D printing, and optical fiber technology.

Course Programme

By nature, the Opto-Mechatronics course programme is multi-disciplinary. We offer a curriculum which will educate you to become an excellent opto-mechatronics engineer. The track will teach you the fundamentals of optics in theory and practice, as well as understanding of high-end optical systems like microscopes, telescopes, interferometers and digital mirror devices. This expertise is combined with mechatronic system design treating dynamics and motion control; micro-system design expertise covering lithography-based micromanufacturing and optical fibers; adaptive optics on actively deformable mirrors and their integration in an opto-mechatronic system; and a course on design principles for precision positioning and thermomechanical stability. In addition, there

is room for electives, such as for instance on more generic topics like engineering dynamics or sensors and actuators, or more specialized ones like space instrumentation or quantum optics, the choice is yours. The combination of these areas forms an excellent basis to becoming an opto-mechatronic scientist or system designer of high-end optical equipment.

This track covers a very wide and multi-disciplinary field. Many specialties come together to develop functional systems that satisfy high performance demands. In the OM track we distinguish two main research areas, micro-optics and opto-mechatronics, each encompassing the above characteristics, yet each at a different length scale.

Degree	Master of Science in Mechanical Engineering
Starts	September
Credits	120 ECTS, 24 months
Language	English
Application deadline	1 April: international students 1 July: Dutch degree
Tuition fee	€ 18.750 (non EU), € 2.083 (EU)
Scholarships	scholarships.tudelft.nl

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First year	Second year
Mechanical Engineering courses (total of 19-22 ECTS) <ul style="list-style-type: none"> • Physics (4 ECTS) • Nonlinear Mechanics (4 ECTS) • Measurement (3 ECTS) • Recommend ME course (≥ 5 ECTS)** • Recommended society oriented course (3-6 ECTS) 	Traineeship/First Project (15 ECTS)
Compulsory courses I (total of 3 ECTS) <ul style="list-style-type: none"> • Student Colloquia and events PME (1 ECTS) • Intro lab PME (2 ECTS) 	Literature survey (10 ECTS)
Compulsory courses II (choose 5 out of 7) (total 19-20 ECTS) <ul style="list-style-type: none"> • Engineering Dynamics (4 ECTS) • Mechatronic System Design (4 ECTS) • Optics (4 ECTS) • Fundamentals of Mechanical Analysis (4 ECTS) • Precision Mechanism Design (4 ECTS) • Micro- & Nanosystems Design & Fabrication, incl. MEMS lab (4 ECTS) • Eng. Optimization: Concept & Applications (3 ECTS) 	Master thesis project (35 ECTS)
Elective courses (15-19 ECTS)**	

*tentative, minor changes possible, ** or other, see ME Obligatory, studiegids.tudelft.nl

Opto-mechatronics

The field of opto-mechatronics by nature is a multidisciplinary field integrating optics and mechatronic system design, and deals with high-tech systems where optical units dominate the speed and precision of operation. High-end lenses and mirrors tend to be large and heavy yet need to be moved and positioned with extreme accuracy and repeatability, in all application areas, such as lithography for semiconductor production, 3D metal printing, extreme accuracy measurement systems, or telescopes for astronomy.

Micro-optics

An emerging trend is evolving towards micro-optics, providing solutions in high-capacity telecommunication, distributed measurement, as well as integration of optical and mechatronic elements for micro opto-electro-mechanical systems (MOEMS), and advanced optical elements for biological and chemical sensing with a special interest in flexible photonic systems. This entails many challenges in numerical modelling, design, materials such as polymer or (silicon) semiconductor nano-photonics, and production.

Graduation projects

The subjects of the graduation projects of some of the past students are listed below.

- Design of a ceramic wafer chuck with integrated mirrors (Mapper Lithography)
- Smart sensor design for a 3 DOF planar positioning stage

- Development of a retinal eye tracker for 3D optical coherence tomography (TNO)
- Design of a linear guide for an optical fibre used in pressure sensitive spectroscopy using a compliant rolling mechanism
- 5DOF precision alignment system for optical fibre with high stability
- Apply vision and low-cost microcontrollers for fast positioning of a 3 DOF stage; an internal feasibility study

Career prospects

Dutch High-Tech industry, including ASML, Hit-tech, TNO, Antheryon, VDL, Zeiss, NXP, Demcon, NTS, FEI and Focal, has great demand for OM engineers. The strong involvement of the industry also leads to interesting and challenging MSc-assignments.

Student Association Taylor

The very active student association Taylor, aims to establish an active link between students and the department staff. Lectures, receptions, visits to industry, and the annual international "Taylor Trip" are organized.



20%
international students

6+

company visits per year

12+

company lunch lectures / drinks per year



monthly social events



international "Taylor trip",
prev. to e.g. Japan, USA,
Canada, China