

Qualification profile „MSc Precision Engineering” (MSc PrE) – specialized Joint Master of the University of Bern, Faculty of Science and the Bern University of Applied Sciences, Department of Technology and Informatics

Degree	MSc in Precision Engineering
Enrolment at	Faculty of Science at the University of Bern
Range, Duration, Start	120 ECTS, 4 semesters (full time), autumn semester
Language	English

Program aims

Precision Engineering is one of the key technologies for successful innovation and, thus, an entry point to future markets. Graduates of our application- and research oriented master program „MSc Precision Engineering” are excellently prepared for the challenges in this multidisciplinary field that connects physics, chemistry, material sciences, micro engineering, mechanical engineering, electrical engineering, material engineering, photonics and information engineering.

In two specializations, students gain a comprehensive overview of the relevant fields of *Ultraprecision Engineering* and *Optical Engineering* respectively in terms of scientific research competence and for occupational qualification and application. Graduates perform engineering tasks in an interdisciplinary context and bridge different engineering areas and professional fields.

The future challenges for industries and in research ask for a contemporary education. The master’s program offers an excellent and innovative education that combines professional and highly demanded transversal skills and competencies to prepare graduates for diverse tasks.

The heart and soul of the master’s program is the unique Creative Engineering Lab: A state-of-the-art learning and teaching laboratory. Here, students learn and develop their skills with the help of professionals. Students implement technical ideas and concepts into products and services in interdisciplinary groups and understand teamwork and communication in a multidisciplinary environment. Our graduates are prepared for positions in industrial R&D divisions, research or entrepreneurship by leading projects and teams.

Thanks to a close connection to leading national and international institutions in industry and research, our graduates will acquire access to a valuable network to further develop their understanding and skills and use them for the benefit of society.

The structure includes a doctoral degree program at the School of Biomedical and Precision engineering at the University of Bern to increase in-depth knowledge.

<p>Professional and methodical competencies</p>	<p>Graduates can:</p> <ul style="list-style-type: none"> - Understand the fundamental principles of simulation, modularization, optical systems, digital technologies, circular industry technologies, advanced materials, and targeted surface modifications - Apply the aforementioned technologies in product developments - Take into account norms, standards, and safety measures in their activities - Plan and design precise, reliable, safe, and sustainable products - Use their knowledge to design competitive products that meet global market requirements - Apply the principles of accuracy and repeatability in product development and implement them in production processes - Design a complete development cycle including modeling, characterization, engineering, and upscaling, also in an industrial environment - Combine new and emerging technologies such as additive and subtractive manufacturing, micro- and nanofabrication with the corresponding optical sensor technology, artificial intelligence, and human-robot collaborations and integrate them into production planning - Solve problems based in both application-based and fundamental methodology - Transfer specialist knowledge and methodical solution-finding skills to new or highly complex tasks and requirements - Independently understand new developments as well as concepts and methods from other disciplines and consider them when solving problems - Realize new and sustainable product characteristics by combining creative methods with advanced technologies - Plan, structure, and lead comprehensive and complex projects and apply the appropriate project management tools - Systematically design, conduct, and analyze scientific and/or industrial experiments and communicate the results - Identify research questions, formulate hypotheses, and work critically with scientific literature - Conduct patent searches independently or under guidance <p>Ultraprecision Engineering:</p> <ul style="list-style-type: none"> - Strengthen and create new types of value chains based on digital industry platforms - Apply methods to increase productivity through digital transformation with the aim to realizing shorter innovation cycles and lower production costs - Integrate zero-waste manufacturing, de- and remanufacturing, including smart recycling, reuse of raw material, repairing and refurbishing products into modern manufacturing processes and environments
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	<p>Optical Engineering:</p> <ul style="list-style-type: none"> - Understand the common principles of optical sensor technology and measurement technology - Identify and use suitable optical components for product developments - Develop unavailable components independently - Simulate optical systems using relevant software - Plan complex optical sensor systems considering modern manufacturing processes - Understand the special requirements for optical systems in extreme environments and special areas of application and implement them in this respect - Collaborate with related disciplines to realize real-time data acquisition (e.g., image processing) and data analysis
<p>Social and self-competencies</p>	<ul style="list-style-type: none"> - Apply high standards of professional expertise, integrity, autonomy, and self-management in their work - Cooperate respectfully and solution-oriented in interdisciplinary and transdisciplinary teams - Generate target group oriented technical documentation - Recognize communication needs and requirements of various stakeholders, and consider them for a targeted oral and written communication - Communicate ideas and results effectively and efficiently in English - Actively participate in and/or lead scientific discussions - Critically question results, including own results, and constructively defend them against criticism - Reflect own actions and question them concerning social expectations, ethical standards and requirements - Take responsibility for socio-economic, economic, and social aspects of their work, which arise from new developmental and manufacturing processes and products