COURSE PLAN – part 1 (Registrations in FS)

*(fields marked with * are compulsory and must be filled out)*

* Included in study programme

Master in Sensor Systems and Innovation

* Course name (Norwegian bokmål)

Material and Device Characterization

* Course name (Norwegian nynorsk)

* Course name (English)

Material and Device Characterization

* Course code (FS)

TBD

* Course level

Master, 3rd year bachelor

* Course scope and organisation

- Number of credits: 5
- Number of semesters: 1 semester (spring)
- Language of instruction: English
- Course organization: Online study with on-campus sessions

COURSE PLAN – part 2 (Headlines in course plan/ Infotypes)

*(Fields marked with * are compulsory and must be filled out)*

* Academic content in course

This course gives a broad background in characterization techniques used for micro and nanotechnology, relevant for sensor, microelectronics and semiconductor technologies. The techniques are described based on physical principles, and how the probing method (optical, electrical, electron-beam, X-ray, probing tips or other) interacts with the material or device under investigation. Emphasis is on interpretation of measurements (microscopy/ imaging, spectroscopy and others) and the understanding of which material/ device parameters are probed with a given characterization technique.

Characterization techniques covered include:

- Microscopy (e.g. optical, electron and atomic force microscopy)
- Electrical measurements (e.g. resistance probing, Hall measurements and capacitance-voltage measurements)
- Optical interferometry
- Thin film measurements e.g. ellipsometry
- Spectroscopy
- X-ray imaging, including tomography

The course will enable the students to choose the most appropriate characterization technique for a given problem. It will provide the foundations for developing in-depth competence for characterization method(s) the student will use in future work.

Required prerequisite knowledge

The course is open to students who hold a bachelor's degree in engineering or technology, or an equivalent qualification, as well as students in the final year of a bachelor's degree programme in engineering or technology.

* Learning outcome

After completing the course, the candidate should have the following overall learning outcomes:

Knowledge

The candidate can:

- demonstrate a good overview of modern characterization techniques based on electrical, optical, chemical and physical principles
- describe the most common characterization techniques such as SEM, EDX, AFM, optical microscopy and interferometry, optical thin film measurements, resistance probing, Hall and C-V measurements
- list and compare key techniques and their applications and limits

Skills

The candidate can:

- plan and perform experiments to characterize material properties of materials used in micro and nano technology systems, as well as electrical characterization of devices
- analyze measurement results based upon understanding of the basic physical measurement principles

General Competence

The candidate will be able to:

- develop in-depth competence of characterization techniques for his/ her master thesis
- select the most appropriate techniques for a specific measurement problem
- apply the skills obtained in materials and device characterization for problems outside the field of micro and nano technology systems

* Learning activities

The course will be organized as an international experience through blended learning, involving online and in-person learning activities. Online learning will include weekly lectures and homework assignments. Learning activities during the in-person component at USN will include lectures, laboratory work, exercises, company visit and group work.

The combination of different learning activities will support the intended learning outcomes and include both theoretical understanding and practical skills in materials and device characterization. The in-person session gives students the opportunity to apply their knowledge in realistic lab environments and through company visits. This strengthens their learning and provides insight into real-world operational contexts.

Supervised professional training

* Compulsory activities

The following coursework requirements must be completed and approved for the student to take the exam in the course:

- Participation in online lectures
- Attendance and participation in lectures, laboratory work exercises, company visit and group work during the physical module.

Assessment: approved/ not approved.

Course expenses

* Form of examination

Project report and presentation, followed by an oral examination, counts 100%.
The oral examination is based on the project report and the course content. The report, presentation and oral examination are considered together in the overall assessment.

Assessment grading A-F; A (highest) to F (lowest). E is the minimum pass grade.

* Examination support material

All aids are permitted, but no time will be set aside during oral examination for checking literature or other sources.

Miscellaneous

Literature (reading list)

The reading list is not published yet.