University of
South-Eastern Norway

Congratulations on getting admitted to Master of Science in Sensor systems and innovation

Welcome to USN!

In this letter you will find important information related to your study programme.

We look forward to meet you!

Hi!

It is our great pleasure to welcome you to the University of South-Eastern Norway (USN) and the Department of Microsystems (IMS). We are delighted that you chosen the Master in Sensor Systems and Innovation, and we hope you take full advantage of all our resources as you embark on an exciting journey into the world of sensors. The faculty and staff at IMS are committed to supporting you and providing the help you need along the way.

Warm regards,

Kristin Imenes
Associate Professor
Programme Coordinator Master in Sensor Systems and Innovation

Startup week

The welcome session for the Master in Sensor Systems and Innovation takes place on 11th August at 10:15 in F2-20, Research Park, while the official opening of the academic year will be held on 10th August at 10:00 at the main entrance. The first week of this programme is tailored to give you the best possible start, and we encourage you to take an active part in as many activities as you can. You will be introduced to the staff and get to know your fellow students.The startup week includes both ice-breaking activities, introduction lectures, a lab tour and industry talks.

<table>
<tr><th></th><th>Tue 11 Aug</th><th>Wed 12 Aug</th><th>Thu 13 Aug</th><th>Fri 14 Aug</th></tr>
<tr><td>09:15</td><td></td><td>Introduction lecture
BIO4200 Biosensor technology
@ G3-32</td><td rowspan="3">Lab tour/
Presentation of
research groups
@Spiseriet Research Park</td><td>Introduction lecture
EMS4000 Electronic measurement systems
@ (see TimeEdit)</td></tr>
<tr><td>10:15</td><td rowspan="2">Welcome
Presentation of USN & IMS
Information about the study programme
@F2-20</td><td rowspan="2">AI in your studies
@ F2-20</td><td>Introduction lecture
MAT4100 Applied mathematics
@ (see TimeEdit)</td></tr>
<tr><td>11:15</td><td rowspan="2">IMS seminar
Industry talks

@A1-30
Food is served</td></tr>
<tr><td>12:15</td><td rowspan="2">Lunch & fun with all
master students at IMS
@Spiseriet Research Park</td><td rowspan="2">Student engagement & volunteering
(in Norwegian)

@A1-30</td><td>Introduction lecture
INS4000 Innovation with sensor technology
@ (see TimeEdit)</td></tr>
<tr><td>13:15</td><td>Introduction lecture
REL4000 Reliability and robustness in sensor systems
@ (see TimeEdit)</td><td></td></tr>
</table>

Timetable

You can find the timetable for the entire semester, including when and where lectures take place here: https://cloud.timeedit.net/usn/web/publikk/ri1X608Yf05060QQ68ZY848Y87y0Z160756Y63Q40f5XQ0.html or min.usn. Please note that the schedule for the startup week differs from the rest of the semester. Minor changes may occur, so we recommend that you check the timetable regularly.

How to prepare

We strongly advise you to review the study plan and the course plans for the different courses.
You can find them here: https://www.usn.no/english/academics/study-and-courseplans/#/studieplan/MASENS_2026_H%C3%98ST.

We assume that all students have basic knowledge of electrical circuits before starting the programme. Students who lack this background or need a refresher will have the opportunity to take an Electrical Circuits course during the first semester (taught in Norwegian): https://www.usn.no/studier/studie-og-emneplaner/#/emne/PB1120_1_2026_H%C3%98ST. In addition, some courses have specific prerequisite knowledge. We therefore recommend that you review the information on the following pages to assess whether your background is adequate.

Students who have been granted conditional admission due to not yet meeting the special admission requirements are encouraged to contact the student advisor as soon as possible to plan how to complete the required courses.

Please also check the semester start pages for continuous updates and information on how to register and activate your student account (deadline 1st of September):
https://www.usn.no/studier/studiestart/oppstartsinformasjon/.

Join us on Open Sunday!

New students and exchange students are welcome to visit our campus on Sunday 10th of August. Read more here: https://www.usn.no/english/newstudents/get-a-head-start-join-in-on-open-sunday.

Special needs?

If you have vision loss, hearing loss, mobility challenges, dyslexia, psychosocial difficulties or other challenges in your everyday life, you may be entitled to special arrengements. Find out more, and how to apply, here: https://www.usn.no/english/academics/special-needs/.

Do you have any questions?

For questions related to your study programme, contact your Programme Coordinator:
Kristin Imenes (Kristin.Imenes@usn.no).

For practical matters, contact your Student Advisor: Anders Sundsdal (Anders.Sundsdal@usn.no).

We look forward to meeting you and working with you over the coming years.

I am convinced that knowledge of sensor technology is essential for finding effective solutions for the society and environment of the future. At USN, you will be seen and heard by your lecturers, and you will gain close connections to working life during your studies.

- Vanessa Skrede, former master student

University of South-Eastern Norway

Electronic Measurement Systems EMS4000

Lecturer: Professor Muhammad Nadeem Akram, muhammad.n.akram@usn.no

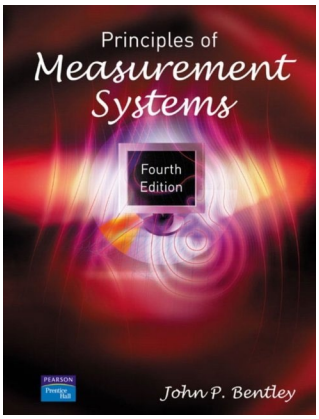
Academic content in course

Electronic Measurement Systems is an introductory master's-level course dealing with sensor measurement circuits and associated modelling theory. The course covers the general operation, design, performance, and characterization of electronic systems incorporating sensing devices. It includes:

- principles of sensing and the design of various sensors
- interface technology for sensors
- both digital and analogue circuits for signal conditioning and processing

Case studies will cover vibration, rotational, optical, and ultrasonic measurement systems.

Course Textbook



Principles of measurement systems,
by John P. Bentley,
4th edition, 2025
(Principles of measurement systems)

Required prerequisite knowledge

Students are expected to have basic knowledge of:

- **Probability theory**: random variables, probability density functions, mean value, variance, standard deviation, Gaussian PDF, uniform PDF
- **Differential equations**: simple differential equations; solving differential equations using the Laplace transform; first-order and second-order differential equations
- **Fourier analysis**: Fourier transform and Fourier series
- **Basic circuit theory**: DC and AC circuit analysis; Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL); determining currents and voltages in a circuit; impedance; finding Thevenin and Norton equivalent models

For students who have not covered these topics previously, extra classes will be offered at the beginning of the semester to go through this material separately.

University of South-Eastern Norway

Applied Mathematics MAT4100

Contact: Anna.Pachol@usn.no
Office: G3 – 15 Vestfold

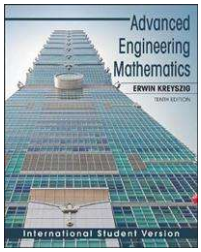
Academic content in course

This course gives an introduction to several core topics in advanced applied mathematics, particularly relevant for signal processing in sensor systems and useful in the mathematical modelling of various physical systems:

- Ordinary differential equations (ODEs): variation of parameter method for higher order linear nonhomogeneous ODEs, series solutions of ODEs and special functions.
- The Sturm-Liouville complex and orthogonal series. Fourier Analysis, Fourier transform: cosine, sine, discrete and fast transforms. Short impulses.
- Linear partial differential equations in cartesian, cylindrical and spherical coordinates.
- Introduction to complex analysis and analytic functions.

Course Textbook

Advanced engineering mathematics



Author: **Kreyszig**, Erwin, in collaboration with Herbert Kreyszig, Edward J. Norminton
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Publication Date: cop. 2011
Publisher: Wiley
Place of Publication: Hoboken, N.J.

Required prerequisite knowledge

Note the below topics are usually covered in the 1st and 2nd year on any engineering bachelor's degree. However, for your convenience, some particularly relevant pre-requisite topics for this course are summarized below with references to the specific chapters in the course textbook indicated. You are welcome to use these or any other resource (including your own notes from your studies) **to revise these topics before the semester starts**.

- First-Order ODEs, Separable, Exact and Linear ODEs (Kreyszig Chapter 1, Sec. 1.1, 1.3 – 1.5)
- Second-Order Linear ODEs, Homogeneous and Nonhomogeneous ODEs (Kreyszig Chapter 2, Sec. 2.1 – 2.2, 2.4 – 2.5 & 2.7, with applications in 2.8 – 2.9). [Comment: Make sure you know how to solve **ODE with constant coefficients**].
- Higher Order Linear ODEs, Homogeneous Linear ODEs (Kreyszig Chapter 3, Sec. 3.2 **case with constant coefficients**).
- Series Solutions of ODEs - **Power Series Method**, Legendre's Equation and **Legendre Polynomials** $P_n(x)$ (Kreyszig Chapter 5, Sec. 5.1 – 5.2)
- Fourier Analysis, Fourier Series, Even and Odd Functions, Half-Range Expansions, Forced Oscillations (Kreyszig Chapter 11, Sec. 11.1 – 11.3) [Comment: Make sure you know how to **find a Fourier series for periodic function, including arbitrary period**].
- Partial Differential Equations (PDEs), Wave Equation, Solutions by Separating Variables, Solutions by Fourier Series (Kreyszig Chapter 12, Sec. 12.1 – 12.4, 12.6) [Comment: Make sure you know how to solve **PDE by separation of variables and by using Fourier series expansion**].
- Complex Numbers and Functions, Complex Differentiation, Complex Numbers and Their Geometric Representation, Polar Form of Complex Numbers, Powers and Roots, Exponential Function, Euler's Formula (Kreyszig Chapter 13, Sec. 13.1 – 13.2)
- Programming skills are required (for solving differential equations in e.g. Matlab or Python)

Prerequisite Assignments (optional)

(Test yourself by attempting the prerequisite assignments. Submit the solutions via e-mail to Anna.Pachol@usn.no any time **before the start of the semester** if you want to receive feedback)

Prerequisite Assignment 1

Solve the following differential equations for $y(x)$

i) $\frac{dy}{dx} = 4y$ (by separation of variables)

ii) $y' - 3y + 2 = 0$

Prerequisite Assignment 2

Solve the following differential equations:

i) $y'' + y = 0$

ii) $y'' + 2y' + 2y = 0$

iii) $y'' + 8y' + 16y = 20e^{-4x}$ with $y(0) = 1 \; and \; y'(0) = 0$

Prerequisite Assignment 3

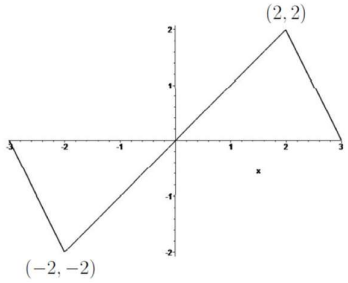
Solve the following differential equations:

i) $y'' + y = 0$ (solve by using the power series method, i.e. assuming the solution of the form $y = \sum_{n=0}^{\infty} a_n x^n$)

ii) $(1 - x^2)y'' - 2xy' + 6y = 0$ (solve by using the power series method)

Prerequisite Assignment 4

a) Compute the Fourier coefficients of the periodic function g with period 6. The function g is given on the interval [-3, 3] by the following figure:



b) Verify by substitution that functions of type $u_n(x,t) = \cos\left(\frac{n\pi t}{3}\right)\sin\left(\frac{n\pi x}{3}\right)$ satisfy the PDE

$$\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2} \qquad\qquad 0 < x < 3, \quad t > 0$$

with the conditions $u(0,t) = u(3,t) = 0$ and $\frac{\partial u}{\partial t}(x,0) = 0$. Then find the solution $u = u(x,t)$ of the above PDE that satisfies an additional initial condition $u(x,0) = g(x)$ with g(x) given in point a).

Prerequisite Assignment 5

i) Calculate $\frac{1+2i}{-2+i}$

ii) Represent the following complex numbers on an Argand diagram showing the direction of each line by an arrow: -4, -I, -2+3i, 3+2i

iii) Represent the complex number -2-2i in the polar form and in an exponential form