Course Package

System Design & Validation – Q3 & Q4

Name module	System Design & Validation – Q3 & Q4
Educational programme	BSc Advanced Technology
Period	Second semester (Quartiles Q3 and Q4)
Study load	15 ECTS
Coordinator	A.W. Schouwstra

<table>
<tr><th colspan="4">System Design & Validation</th></tr>
<tr><th>Quartile 1</th><th>Quartile 2</th><th>Quartile 3</th><th>Quartile 4</th></tr>
<tr><td rowspan="3"></td><td rowspan="3"></td><td>Electro- and Magnetostatics
202200177 (5 EC)</td><td>Electrodynamics
202100136 (3 EC)</td></tr>
<tr><td>Numerical Simulation of Physical Systems
202600291 (4 EC)</td><td>Electromagnetic Radiation (Project Antenna)
202000654 (3 EC)</td></tr>
<tr><td>Data Analysis and Statistics for Engineers
202500402 (3 EC)</td><td>Machine Learning
202500557 (3 EC)</td></tr>
<tr><td rowspan="3"></td><td rowspan="3"></td><td colspan="2">Entrepreneurship & Innovation Management
202000656 (6 EC)</td></tr>
<tr><td colspan="2">Vector Calculus
202200189 (2 EC)</td></tr>
<tr><td colspan="2">Challenges in Science and Engineering 2
202500401 (1 EC)</td></tr>
</table>

Required preliminary knowledge: High school Physics; Calculus of Integrals; Integrals in Multiple Dimensions: including double and triple integrals; high school Math; Programming Skills, i.e. Matlab or Python.

Note: Please be aware that resits may take place outside the block, which may require you to make additional travel arrangements in order to attend them.

Quartile 3

202200177 - Electro- and Magnetostatics

By applying the concepts of Vector Calculus, you will solve and discuss successive problems with a small group of students to get insight first in electrostatics, followed by magnetostatics. With magnetostatics you are already able to understand the design of electromagnets, magnetic fields created by a constant current.

Fields: vector- and scalar fields, gradient, divergence, curl, flux and circulation of vector fields, Theorems of Gauss and Stokes;

Electrostatics: electric field, Coulomb's Law, superposition of fields from charges and charge distributions, Gauss's Law, electrostatic potential, electric dipole, electrostatic energy, dielectrics;

Magnetostatics: magnetic field, Lorentz force, Ampere's law, law of Biot and Savart, vector potential, current and current density, magnetic dipole, magnetostatic energy.

202600291 - Numerical Simulation of Physical Systems

The modules are tentative and subject to change. Please check the website regularly.

202500402 - Data Analysis and Statistics for Engineers

The course ' Statistics for Engineers' is a follow up on the statistics you learned during the practicals. Important topics that will be covered include: population and sample statistics, propagation of errors , hypothesis testing and analysis of variance, linear regression, regression diagnostics, multiple regression analysis, transformation of experimental data, nonlinear regression, correlation. Implications of these kind of data analysis in he real world, like production facilities, reliability and quality control will be used as examples. Emphasis is placed on practical implementation in MATLAB.

202000656 - Entrepreneurship & Innovation Management

Students will obtain hands-on project experience in the entire entrepreneurship process from working on an initial technological idea to delivering a commercially viable product. Students will not only be able to understand complex system design, but also commercial, organizational and societal aspects that are at least as important for success as the technology itself. Since group work is an important part of the module, effective collaboration, reflection and presentation skills will also receive substantial attention. The engaging "Entrepreneurship and Innovation Management" course offers essential skills and insights to thrive in the dynamic world of modern business. Throughout the program, you'll delve into core principles and theories of entrepreneurship and innovation, dissect business models by focusing on elements like value proposition, customer segments, and revenue streams, and construct innovative, technology-driven business models for sustainability, all supported by empirical financial planning. The course consists of both lectures and practical projects, enriched by a business acceleration program.

202200189 - Vector Calculus

This course focuses on the calculation of vector fields. The concepts of rotation, divergence and gradient are introduced, and special attention is given to conservative vector fields. In addition, integrals of vector fields along a line, a surface and 3D volume are treated, using the theorems of Green, Stokes and Gauss (Divergence) to establish relationships between these different types of integrals. This provides more insight into the meaning of integrals of vector fields and important theoretical relationships, but can also often be used to calculate these integrals more easily. The three big theorems of Vector Calculus extend the Fundamental Theorem of Calculus into higher dimensional spaces.

202500401 - Challenges in Science and Engineering 2

In the second year of the **Advanced Technology** program, students prepare to make an informed decision about their follow-on study after graduation. A key aspect of this decision is understanding how science and engineering are applied beyond the university setting.

This course offers students the opportunity to participate in a series of **mandatory excursions** to companies and research institutes operating in fields related to Advanced Technology. These visits provide insight into professional environments, current technological applications, and career opportunities. Based on these experiences, students will write an assignment reflecting on how the excursions influence their plans for further study or career development.

Quartile 4

202100136 - Electrodynamics

Electrostatics and magnetostatics are combined in the field of electrodynamics, the mutual interaction of electric and magnetic fields. This forms the basis to understand optical effects and wireless communication. This will be required knowledge to be used for the design and realization of an antenna in the project.

Waves: the wave equation and its solutions;

Electrodynamics: induction, plane waves in free space, radiation, interference, polarization, resonance in cavities, waveguides, transmission lines, phase and group velocity, pointing vector, reflection and diffraction.

The modules are tentative and subject to change. Please check the website regularly.

202000654 - Electromagnetic Radiation (Project Antenna)

Electrostatics and magnetostatics are combined in the field of electrodynamics, the mutual interaction of electric and magnetic fields. This forms the basis to understand optical effects and wireless communication. This knowledge will have to be used in the project team for the design and realization of a directive antenna that works at 433 MHz. To support the antenna design process the Finite Element Method (COMSOL) is applied. Key here is to critically compare the measured performance of the realized antenna to the expected performance based on calculations and simulations.

202500557 - Machine Learning

Machine Learning (ML) and Artificial Intelligence (AI) are fast expanding topics in mathematics (e.g., statistics, control), computer science, robotics, engineering and science in general. In the field of computational physics and chemistry ML is on the rise to learn simple models based on data produced by numerically solving complex equations on supercomputers.

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