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HÖGSKOLAN I BORÅS

Digital printing processes for smart and functional textiles

Digitala tryckprocesser för smarta och funktionella textilier

3-5 credits

Level: Advanced level
Subject area: Textile technology
Pre-requisites: Bachelor's degree in textile technology or 30 credits of undergraduate course/s in textile technology of which at least 3 credits in dyeing and finishing and at least 2 years of work experience in textiles

Content

The course is intended as a teaching module, which can be added to other courses in the areas of textile dyeing, printing and functionalization or the development of smart-functional textiles. The module is primarily suitable for education on master and doctorate level or as commissioned education.

This course focuses on an applied research approach to get a deeper understanding in digital printing as a resource-efficient process to produce textile materials for smart and functional applications. Digital printing is a complex technology where many factors influence print quality and hence product properties. In this course the emphasis lies on ink properties and printing process parameters that can influence the quality and functionality of printed smart and functional textiles. It also emphasizes on the opportunities but also the limitations and challenges of the technology of digital printing to innovate and develop smart and functional textiles.

This course is intended for learners who want to deepen their knowledge in digital printing such as inkjet and valve-jet technologies to enable the development of smart and functional textiles. The course combines theoretical knowledge through lectures and practical knowledge through digital lab training using VR and physical lab training on campus. The combination of digital and physical labs allows the learner to practice and be prepared for the physical labs, which boosts the understanding for the intended application of digital printing.

After completion of the course, the learner shall independently demonstrate the opportunities and limitations of using digital printing for building blocks to produce a textile material for smart and functional applications. The learner is expected to reflect on implications on sustainability and the own need for further knowledge in the field.

The course consists of two obligatory parts (part 1 and 2) and one optional part (part 3): 1. Digital printing for smart and functional textiles; 2. Practical training and 3. Project work

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Part 1: Digital printing for smart and functional textiles (2 ECTS)

In this part, state-of-the-art digital printing techniques are introduced (ink-jet printing/valve-jet/3D printing) with their respective specifications, opportunities and limitations in relation to smart and functional textiles. Furthermore, ink properties such as viscosity, surface tension and particle size, as well as printing process parameters such as ink velocity, drop size, waveform, temperature and print resolution.

Part 2. Practical training (1 ECTS)

The second part, the practical training, focuses on the development of functional inks and consists of three main steps, which will be initially done virtually with a digital twin to practice and get familiar with the inkjet technology. After completion of the virtual training physical labs will be done on campus. Both the virtual and the physical labs contain the following training steps:

- Formulation of ink
- Testing of ink
- Observation of ink upon jetting (drop formation)

Part 3. Project work (2 ECTS)

In the third part, which is optional to include in the course, the acquired knowledge from theory and the practical training is applied in a project work. The topic of the project work is determined by the learner itself in relation to the course contents.

Learning Outcomes

Upon completion of the course, the student should be able to, with regard to:

Knowledge and Understanding
1.1 Demonstrate systematic understanding of technical knowledge of digital printing processes for the intended development of smart and functional textile products.
1.2 Demonstrate understanding of the opportunities and limitations of state-of-the-art technologies to innovative and develop printed smart and functional textiles.

Skills and Abilities
2.1 Conduct virtual and physical lab training in formulation, testing and observation of ink.
2.2 Identify challenges in ink development and printing process parameters affecting quality and functionality of printed smart and functional textiles.
2.3 Demonstrate methodological and intellectual skills required to work with an own project.

Judgement and Approach
3.1 Reflect on the opportunities, limitations and challenges of the state-of-the-art digital printing processes in relation to sustainability aspects.
3.2 Reflect on the individual need for further knowledge required to develop smart and functional textile materials using digital printing technologies.

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Forms of Teaching

- Lectures
- Lab training (virtual and on campus)
- Supervision
- Seminar

The language of instruction is English.

Forms of Examination

Exam
Credits: 2
Grade: Pass/Fail

Lab training
Credits: 1
Grade: Pass/Fail

Assignment – project work
Credits: 2
Grade: Pass/Fail

Literature and Other Course Material

Course material is made available on the university's learning platform.