SENCE Hochschule für Technik Stuttgart | Hochschule für Forstwirtschaft University of Applied Forest Sciences Rottenburg | Technik Informatik & Medien Hochschule Ulm University of Applied Sciences

Module description Master course SENCE (Sustainable Energy Competence)

Module 1.1 Sustainable Management – Resources (8 ECTS)

This module provides an introduction to aspects of resource economics and environmental politics with regard to renewable energy. The contents of the technologically-oriented modules 1.3 and 1.4 (sustainable energy – industrial and building systems) are examined for their socio-economic and political relevance. The fundamentals and instruments of sustainable economic management as well as the general socio-political framework and its specific political consequences (eg. in the form of benefits or rates for social costs) are dealt with.

Module 1.2 Scientific Work Methods and Project Management (6 ECTS)

Building on basic knowledge of the historical development and characteristics of scientific theory, this module conveys wide-reaching knowledge of the techniques of working scientifically and the production of various types of scientific texts. This transfer of knowledge, aimed firstly at individual skills, is then broadened by its transfer, application and integration in team- and project-oriented work. The focus of this module is on group-oriented techniques of modern management theory, taking the social aspects of teamwork into consideration.

Module 1.3 Sustainable Energy – Industrial Systems (8 ECTS)

This module contains all relevant energy conversion technologies for renewable energy and efficient energy utilisation plants in so far as these are not components of building systems (module 1.4). The module consists of one lecture on basic principles (thermodynamics) and further application-oriented
lectures in which the individual energy conversion plants are dealt with in detail. Commensurate with the differing states of knowledge of students from different courses, the lecture on basic principles creates a common basis for understanding energy conversion plants. The consolidating lectures focus on imparting an overall understanding of the technical perspectives and resulting criteria for the construction and operation of the plants.

Module 1.4 Sustainable Energy – Building Systems (8 ECTS)

Building on the theoretical principles of heat and mass transport, the thermodynamics of state and phase transformations and the theory of thermal comfort, sustainable structural and systems engineering energy planning for buildings is dealt with. This includes climatic and user-oriented demands on energy technology in buildings, energy accounting in buildings in accordance with DIN V 4108-6, DIN V 4701-10 and DIN V 18599, and proof of energy efficiency in accordance with the regulation on energy saving. Another aspect is the productive potential of regenerative energy in the building such as long-term provision of heating using wood-burning systems, geothermics, solar technology as well as the use of waste heat and environment heat using heat pumps. In addition, this module involves integrated photovoltaics as well as the energy supply for cooling systems by means of absorption coolers and solar cooling systems. The subjects involved in power supply planning for buildings is rounded off by the principles of eco-accounting.

Module 2.1 Introduction to Project and Team Work (2 ECTS)
Module 2.1 provides an introduction to working scientifically for the first two projects. This module consists of a methodological introduction to concept development of the projects in application-oriented research. It includes the preparation of time and flow charts, methodological procedure and the definition of what is expected from the results of the project.

Module 2.2 Project 1 (13 ECTS)
In module 2.2 the first scientific project is carried out in one of the participating universities, another scientific institution or an industrial firm. The project comprises familiarisation with a topic from the whole spectrum of renewable energy technology, compiling an exact project plan, carrying out a scientific analysis and drawing up a project report.

Module 2.3 Status Seminar
In module 2.3 the scientific results of the first project are presented and discussed in a status seminar. This module consists of all students giving presentations of their project results from the complete area of renewable energy technology. After the presentations there is a detailed discussion of the project results and development of concepts for further work.

Module 2.4 Project 2
In module 2.4 the second scientific project is carried out in one of the participating universities, another scientific institution or an industrial firm. The project comprises familiarisation with the topic from the whole spectrum of renewable energy technology, compiling an exact project plan, carrying out the scientific analysis and drawing up a project report.

Module 3.1 Sustainable Energy Economics
At the beginning of the third semester, the numerous projects already addressed put both application-oriented and research-oriented broadening and deepening of the cross-sectional knowledge acquired during the first semester on the agenda. The module “Sustainable energy economics” consolidates this gain in knowledge and experience systematically by requiring the students to give a paper and prepare for an oral examination and thus puts the various projects at the disposal of all students of this semester. A listing of the key aspects by the course supervisor and conducting an examination colloquium in the framework of the seminar serve as a guideline.

Module 3.2 Mathematical and Scientific Model Design
Mathematical and scientific model design is a prerequisite for a large part of scientific Master work in which theoretical model approaches are converted or applied. Module 3.2 thus aims to convey the theory of simulation and mathematical design for the fields of renewable energy systems, radiation meteorology and buildings. Firstly the basic structures of simulation systems particularly suitable for network analyses, optimization problems, time series simulations and others are presented. Then analytical and numerical solution methods, their limits and potential, are discussed. The processing of large amounts of data in divided energy systems in communal building operation is dealt with using data bank systems and geo-information systems. Besides the theoretical parts, students work on the practical side of simulation systems and independently work out a simulation-based solution for a scientific technical engineering problem.

Module 3.3 Business Seminar
Based on the first semester economics lectures, this module imparts user knowledge, background and practical recommendations as steps to business independence both as free-lancer and as project leader in a business company. The main theme of the module is based on a business from the service sector (consultation sector).

Module 3.4 Development of a Research Project

Module 3.4 imparts the methodology for developing research projects. On the basis of various scientific project areas of applied research, structures for research applications are developed for the various requirement profiles of state and non-state project sponsorship, which can simultaneously be applied to the concept for a scientific master thesis. Apart from an introduction into national and international research sponsoring, this seminar includes the development of a scientific project application describing the latest developments in science and technology, the aims, and a resource and work schedule.

Module 4 Master Thesis

Description, detailed definition and working out of a scientific theme:

- consolidation of the level of knowledge
- task description and formulation of the objective
- development of the methodological approach and research design
- concept for a work and time schedule
- gathering data and developing the results
- evaluation and classification of the results
- definition of further need for research and suggestion of according concepts
- preparation of a written report, presentation of results
- defence of thesis