

5. Department of Mechanical Engineering

1

【Course Code】 70120223

【Course Title】 Manufacturing Technology I

【Semester】 Autumn **【Credits】** 3

【Cross Registration】 YES

【Brief Introduction】

This course gives the graduate students a fundamental and in-depth understanding in manufacturing engineering and its development, including the manufacturing process planning, precision manufacturing process analysis/modeling/measurement/evaluation, and innovation under engineering context. The lectures are given in English, and focuses on the learning through interpreting and team-working on real-word projects.

2

【Course Code】 80120692

【Course Title】 Numerical Simulation of Manufacturing Processes

【Semester】 Spring **【Credits】** 2

【Cross Registration】 YES

【Brief Introduction】

The course is designed by National Professor, Yiming Rong. The course has been designed to focus on fundamentals and numerical modelling technology for manufacturing processes. The newest commercial CAE software packages have been provided for projects and exercises. The content of this course includes the fundamentals, complete procedure and state-of-art on applications of numerical simulation technology in modern manufacturing engineering. The goal of this course is to help students to grasp basic concepts and main steps in numerical simulation for manufacturing processes systematically, to connect the manufacturing theory with modelling technology, to understand the state of art and tendency of the technology, to extend the capability of analyzing and solving problems. It will be foundation of digitalization of manufacturing processes that has been developing rapidly.

3

【Course Code】 80120723

【Course Title】 Manufacturing Technology II

【Semester】 Spring **【Credits】** 3

【Cross Registration】 YES

【Brief Introduction】

Manufacturing Technology II is one of courses belonging to the joint master degree program of RWTH Aachen in Germany and Tsinghua University, and open of international students. The main purpose of this course is to teach postgraduate students materials forming mechanism, and production procedure, productivity and cost about material forming techniques which consist of casting, sintering, and metal

forming technology. Besides metallurgy and the processing method knowledge, the course also teaches students how to analyze and compare different manufacturing methods by considering dimension accuracy, production efficiency and costing of these methods, and using methods of technology planning. Forming technology is the main part of this course, which includes metallurgical basics in plastic deformation, bulk forming, blanking, and forming tools and tribology. The course is given in English and offered to international students whose majority is Production Engineering, Industrial Engineering, or Mechanical Engineering. The course is given in every week, 3 units per week.

4

【Course Code】 80120253

【Course Title】 Welding Technology I: Welding and Cutting Technologies

【Semester】 Spring **【Credits】** 3

【Cross Registration】 YES

【Brief Introduction】

The course is to introduce the principles and applications of welding and cutting methods, as well as the state of the art of the technologies. The students would understand the related knowledge of modern welding and cutting technologies, and the frontier of the disciplines. The abilities of creative thinking and research would also be cultivated. The main contents of the course include different welding and cutting methods, for example, gas welding, arc welding, resistance spot welding, pressure welding, high energy beam welding, and etc. the welding automation, sensors, stress and deformation would also be introduced for their new development and applications.

5

【Course Code】 80120742

【Course Title】 Fundamentals of Finite Element Method for Engineers

【Semester】 Autumn **【Credits】** 2

【Cross Registration】 YES

【Brief Introduction】

This course covers both fundamental theories and engineering applications of finite element method (FEM). By means of lectures in class, projects on computers, and solutions to practical engineering problems, the students are enabled to learn the fundamental mathematical and mechanic theories of finite element method, and obtain the capabilities of modeling and analyzing in handling the practical engineering problems with finite element method.

6

【Course Code】 70120253

【Course Title】 Tribology

【Semester】 Spring **【Credits】** 3

【Cross Registration】 YES

【Brief Introduction】

Main contents include basic theoretical courses and experiments of tribology. The basic theoretical section is mainly composed of lubrication, friction and wear. In the lubrication section, lubricant properties, Reynold equation, lubrication of slider, thrust bearing and journal bearing, classic elastic hydrodynamic lubrication, nano film lubrication and boundary lubrication are mainly involved. In the friction and wear sections, surface topography, friction mechanism, micro and macro wear mechanism are presented. The task of the experiments is mainly to consolidate the basic knowledge in the theoretical section. In the experimental section, some techniques on measurements of surface topography, surface properties, surface modification and tribological tests are briefly introduced. Finally a tribological experimental investigation on lubrication, friction coefficient and wear of some frictional pairs involving different lubricants and surface coatings is required and an analysis report on the basic theory of the experiment should be finished.

7

【Course Code】 80120772**【Course Title】** Advanced Control of Mechatronic Systems**【Semester】** Spring **【Credits】** 2**【Cross Registration】** YES**【Brief Introduction】**

This is a new graduate course taught in English within Mechanical Engineering, Automatic Control or other related areas. Combining precision machine design and electrical knowledge, the course will emphasize precision mechatronic system design and servo control techniques. Applications from automotive industry to advanced manufacturing will be covered, and the approach of design, modeling and control will be emphasized throughout the course.

8

【Course Code】 70120233**【Course Title】** Machine Design Process**【Semester】** Autumn **【Credits】** 3**【Cross Registration】** YES**【Brief Introduction】**

This course is opened to the postgraduate students in accordance to the syllabus of Machine Design Process of 48 lectures. All students in mechanical engineering school and other relative directions are welcome. This course mainly covers the structure design of spatial robot mechanism, design of higher transmission mechanism, kinematics and dynamics of spatial robot, mechanical system dynamics, analysis and design of supporting system and high speed shaft, analysis and design of flexible mechanical system, design of spring, dynamic load and its effect on the fatigue of the mechanical system, design of flexible mechanisms and some issues in system design. The teaching activities include but not restrict to class lecture, homework, project training, and class discussion.

9

【Course Code】 80120612

【Course Title】 Computer-Aided Tissue Engineering (CATE)

【Semester】 Autumn **【Credits】** 2

【Cross Registration】 YES

【Brief Introduction】

Introduction to Computer-Aided Tissue Engineering (CATE) is designed for graduate and senior undergraduate students in engineering and bioengineering major who are interested in acquiring the knowledge and skill in utilizing computer-aided technologies for tissue engineering application. The course will introduce: 1) the engineering and bioengineering aspect of tissue regeneration; 2) basics of computer-aided design, computer-aided engineering, and computer-aided manufacturing (CAD/CAM/CAE); 3) knowledge on the use of integrated CAD/CAE/CAM technology in tissue engineering application; and 4) a hand-on experience on using enabling CAD, medical imaging processing and three-dimensional reconstruction software, and solid freeform fabrication system for tissue scaffold design, modeling, simulation, and freeform fabrication.

10

【Course Code】 80120832

【Course Title】 Introduction to Advanced Medical Device Design and Fabrication

【Semester】 Autumn **【Credits】** 2

【Cross Registration】 YES

【Brief Introduction】

This course is designed for graduate and senior undergraduate students in engineering and bioengineering major who are interested in acquiring the knowledge and skill in advanced medical device technologies and their applications. The course will cover: 1) the engineering and biology aspects and fundamentals of advanced medical devices; 2) basics of design, engineering, and fabrication of In-vitro diagnostics, advanced medical imaging systems, implants, wearable medical device; the development procedures and evaluation methodologies of medical devices; and 4) the quality controls and regulations of medical devices in different countries and regions.

11

【Course Code】 80120882

【Course Title】 Laser Application

【Semester】 Autumn **【Credits】** 2

【Cross Registration】 YES

【Brief Introduction】

Starting from a brief overview over today's applications of laser technology, the Fraunhofer ILT and Chair for Lasertechnology LLT at RWTH Aachen University are introduced. The differences between thermal light and laser light are illustrated and discussed in terms of mode occupation and coherence. Furthermore, it is shown how a

selection of longitudinal and transverse modes is performed inside a laser resonator and which basic physical principles are needed for the description of the light and material interaction. We introduce the laser rate equations and the corresponding energy levels of the active media. The students know the fundamental characteristics of laser radiation with respect to laser material processing. They are able to calculate beam parameters and process parameters including the basic properties of the Gaussian beam and the ability to calculate its changes with propagation in simple optical systems. They know the setup of gas, solid state and diode lasers in principle and understand the function of their components. Furthermore, the students are familiar with the relevant interactions of light and matter, as well as diffusion processes inside the work piece and know the industrial applications of laser materials processing and measurements with lasers. Based on this, the students calculate system parameters of basic applications which are relevant to daily practice. They know the physical mechanisms and typical parameters of the relevant industrial laser applications and are able to compare results to the common state of technology.