Department of Mechanical Engineering

(1)【Course Title】**Manufacturing Technology I** 制造技术(1)

【Course Code】70120223

【Credits】3

【Credit Hours】48

【Semester】Autumn

【Capacity】30 Graduate Students

【Instructor】WANG Hui 王辉

【Course Description】

The course covers the fundamental and advanced manufacturing technology through the informative, analytical, and digital study of the material processing technology (e.g. turning, milling, drilling, and grinding), manufacturing process planning, and other advanced precision manufacturing technology. Through the course lectures, both material processing principle and its application in industry will be taught from both qualitative and quantitative perspectives. Therefore, the students will be capable in understanding the fundamental and applying such fundamental into practical cases. Meanwhile, a course project is the mandatory part of this course, which encourage students to work on a practical manufacturing related project with international students under the multi-discipline background. In the project, the most advanced analytical and research theory related with manufacturing technology is used to enhance the problem solving capability, communication skill, and understanding of the principle of the manufacturing process.

（2）【Course Title】**Machine Design Process** 机械设计进程

【Course Code】70120233

【Credits】3

【Credit Hours】48

【Semester】Autumn

【Capacity】35 Graduate Students

【Instructor】ZHAO JingShan 赵景山

【Course Description】

This course focuses on the sustainable design methodology for innovative product, from concept design to mechanism design, from kinematics to dynamics, from strength analysis to material selection and integration of sandwich materials in hybrid structures, from fatigue analysis to life estimation, from sustainable product development to product lifecycle management (PLM), from geometry design to structure optimization.

The major contents of the course cover structure synthesis of spatial mechanisms, transmission with higher pairs, kinematics analysis of spatial mechanisms, kinetostatic force analysis of spatial mechanism, multibody system dynamics, supporting system, high speed shafts and axles, flexible mechanical elements, mechanical springs, fatigue failure resulting from variable loading, design of compliance mechanism.

The lectures are given in English, and accomplished by interpreting, discussion and team-work on some projects. Therefore, the course aims at cultivating the students with the international vision, team-work capability, and the innovative ability.

（3）【Course Title】**Tribology 摩擦学**

【Course Code】70120253

【Credits】3

【Credit Hours】48

【Semester】Spring

【Capacity】20 Graduate Students

【Instructor】WANG JiaDao 汪家道 TIAN Yu 田煜 SHAO TianMin 邵天敏

【Course Description】

The course is a systematic presentation of tribology fundamentals, and the current state and development trend in tribology research. It mainly consists of three parts including lubrication, friction and wear. Besides the classical tribology contents, it also covers scopes of surface forces, contact mechanics

and other current attractive topics in tribology. Additionally, typical tribological instruments and experiments will be introduced to enhance the concepts of the tribology.

（4）【Course Title】**Welding Technology I: Welding and Cutting Technologies**
焊接技术 I：焊接与切割方法

【Course Code】80120253

【Credits】3

【Credit Hours】48

【Semester】Spring

【Capacity】30 Graduate Students

【Instructor】ZHAO HaiYan 赵海燕

【Course Description】

（5）【Course Title】**Computer-Aided Tissue Engineering (CATE) 计算机辅助组织工程**

【Course Code】80120612

【Credits】2

【Credit Hours】32

【Semester】Autumn

【Capacity】30 Graduate Students

【Instructor】SUN Wei 孙伟

【Course Description】

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.

（6）【Course Title】**Numerical Simulation of Manufacturing Processes** 制造过程数值模拟技术

【Course Code】80120692

【Credits】2

【Credit Hours】48

【Semester】Spring

【Capacity】20 Graduate Students

【Instructor】WANG Gang 王罡 RONG YiMing 融亦鸣

【Course Description】

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.

（7）【Course Title】**Fundamentals of Finite Element Method for Engineers** 工程有限元法基础

【Course Code】80120742

【Credits】2

【Credit Hours】32

【Semester】Autumn

【Capacity】20 Graduate Students

【Instructor】CHANG BaoHua 常保华

【Course Description】

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 mathematical and mechanic theories of finite element method, and obtain the capabilities of modeling and analyzing in dealing with the practical engineering problems with finite element method. The lectures consist of the following three parts.

The first part covers mainly the fundamental theories of finite element method, including the FEM of trusses and beams structures, in addition to the mechanical description and the finite element method of the continuous deformable body.

The second part is the specific applications of FEM, including analyses of static structures, heat transfer problems and vibration problems.

Finally, taking several typical cases as examples, students will construct finite element models and carry out the analyses with advanced finite element analysis packages, so as to cultivate their capability of solving engineering problems with the finite element method.

（8）【Course Title】**Manufacturing Technology II** 制造技术(2)

【Course Code】80120723

【Credits】3

【Credit Hours】48

【Semester】Spring

【Capacity】20 Graduate Students

【Instructor】SHIWei 石伟

【Course Description】

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

（9）【Course Title】**Advanced control of mechatronic systems 精密机电系统的先进控制**

【Course Code】80120772

【Credits】2

【Credit Hours】32

【Semester】Autumn

【Capacity】20 Graduate Students

【Instructor】ZHANG Zhen 张震

【Course Description】

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.

（10）【Course Title】**Introduction to Advanced Medical Device Design and Fabrication** 高端医疗器械设计及制造概论

【Course Code】80120832

【Credits】2

【Credit Hours】32

【Semester】Autumn

【Capacity】20 Graduate Students

【Instructor】Tao Xu 徐弢

【Course Description】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 Title】**Laser Application** 激光及其应用

【Course Code】80120882

【Credits】2

【Credit Hours】32

【Semester】Spring

【Capacity】40 Graduate Students

【Instructor】Wenpeng 温鹏，Reinhart Poprawe

【Course Description】

Starting from a brief overview over todays 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.

(12)【Course Title】**Engineering Materials** 工程材料

【Course Code】20120293

【Credits】3

【Credit Hours】48

【Semester】Spring

【Capacity】20 Graduate Students

【Instructor】CHANG Baohua 常保华

【Course Description】

This course combines the fundamentals of engineering materials with their applications. By means of lectures, discussion, and lab exercises, the students

are enabled to understand the relationships among the four elements of materials science and engineering, i.e., composition and processing, microstructure, property, and performance. The lectures consist of the following three parts.

The first part briefs the atomic-level structures of engineering materials, including the interatomic bonding, crystalline and noncrystalline structures, crystal defects, crystallization, and atomic diffusion.

In the second part, the basic relationship between structures and mechanical properties is introduced. The stress-strain behaviors and strengthening mechanisms of metallic, ceramic and polymeric materials, as well as the fracture failure are correlated with the structures. In addition, the development of equilibrium microstructures in binary alloys (including Fe-C alloys) and ceramics is analyzed with reference to the phase diagrams. Furthermore, the heat treatments of steels and nonferrous alloys are introduced, and the metastable microstructural development and mechanical property alteration are described.

The third part gives a general introduction about the typical compositions, processing, and applications of structural materials, covering metal alloys, ceramics and glasses, polymers, and composites. The necessity of corrosion and wear control for metal alloys is also included. The physical properties of functional materials are briefed, with a focus on their applications in thermal, semiconducting, dielectric, piezoelectric, magnetic, superconductive, and optical devices.

Finally, case studies are implemented to help the students acquire a comprehensive understanding of the selection of appropriate engineering materials in such challenging areas as aircrafts, spacecrafts, vehicle engines, and gas turbines, etc.