The Undergraduate and Graduate Courses Taught in English and Open to the International Visiting/Exchange Students at Tsinghua University (Fall Semester, 2018)

Note:

(1) The course information provided herein may be subject to change before course registration.

(2) The courses of a department/school are preferentially open to the exchange students of the department/school.

(3) The graduate courses in the School of Economics and Management are open only to the exchange students majored in Economics.

(4) The Elementary Chinese courses in ICLCC are preferentially open to the university-level exchange students.

1. School of Aerospace

(1)【Course Title】Computational Methods for Reacting Flows
反应流计算方法
【Course Code】80310473
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】30 Graduate Students
【Instructor】REN Zhuyin 任祝寅
【Course Description】
This course focuses on computational methods for flows with chemical reactions. A review of governing equations and fundamental concepts of combustion and turbulent flows is first given. The characteristics of reaction source term and the integration methods for stiff ordinary differential equations (ODE's) governing chemical equations are discussed. The course is then focused on introducing the operator splitting schemes, finite volume and finite difference methods, probabilistic simulation techniques for reacting flows. Properties such as accuracy, stability and implementation will be discussed. Emphasis is made to identify key issues in the applications of the different methods in simulating practical propulsion and power generation systems.

(2)【Course Title】Engineering Mechanics
工程力学
【Course Code】20310504
【Credits】4
【Credit Hours】72
【Semester】Fall
【Capacity】30 Undergraduate Students
【Instructor】ZHENG Lili 郑丽丽
【Course Description】
A review of vector algebra. Concept of force. Equilibrium of particles. Moments about points and lines, couples and equivalent force systems. Equilibrium of rigid bodies. Analysis of simple structures such as trusses, frames, and beams. Centroids, centers of gravity, and moments of inertia. Dry friction with applications to wedges, screws, and belts. Method of virtual work, potential energy, and stability. Vectorial kinematics of particles in space, orthogonal coordinate systems. Relative and constrained motions of particles. Dynamics of particles and the systems of particles, equations of motion, energy and momentum methods. Collisions. Two- and three-dimensional kinematics and dynamics of rigid bodies. Moving frames and relative motion. *Free, forced, and damped vibrations of particles and rigid bodies.

2. School of Architecture

(1)【Course Title】Theory and Practice of Regional Architecture
地域建筑理论与实践
【Course Code】80000891
【Credits】1
【Credit Hours】16
【Semester】Fall
【Capacity】25 Graduate Students
【Instructor】LI Xiaodong 李晓东
【Course Description】
The course implements a strong integration between theory in international discourse, and practice in contemporary Chinese architecture. The course is organized in a weekly pattern of one lecture paired with one seminar. For each week there will be one topic. The currently proposed topics are: 1 Classical and Anti-Classical; 2 Autonomy; 3 Critical Regionalism; 4 Events and Sustainability; 5 Centralization and De-Centralization; 6 Reflective Thinking and Innovation; 7 The Representational and the Ontological; 8 The Verticality and the Horizontality.

(2)【Course Title】History of Chinese Architecture
中国建筑史
【Course Code】80000901
【Credits】1
【Credit Hours】16
【Semester】Fall
【Capacity】20 Graduate Students
【Instructor】
【Course Description】
Development of Chinese Architecture; Cultural Background of Chinese Architecture; Palace; Garden; Urban and Vernacular Architecture.

(3)【Course Title】Building Energy Efficiency Diagnostics
大型商业建筑节能诊断方法
【Course Code】80000942
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】30 Graduate Students
【Instructor】XIA Jianjun 夏建军
【Course Description】
Building energy efficiency diagnostics will be mainly focused on the study on commercial building HVAC system and lighting system on-site energy performance investigation, diagnostics and system retrofitting methods introduction. By lecture study and field practicing in the building projects, by the

end of the BEED course, participants should be able to: 1.Understand the present building energy performance in different regions 2. Identify and discuss the key practices of building energy efficiency; 3. Analyze the costs and benefits of incorporation of building energy efficiency measures; 4. Work with architects, designers, builders, building operators, and utilities to improve a building's energy performance. The lectures will be given by the professors from Tsinghua University (70%) and University of Pennsylvania (30%).

(4)【Course Title】Design Studio I
设计专题一
【Course Code】80001043
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】25 Graduate Students
【Instructor】LI Xiaodong 李晓东
【Course Description】
Design scope of the theme is located in the southwest of the Summer Palace in the Three-hill Five-garden area in BeiJing northwest suburb, reaching BeiWuLu village in the west, the northwest fourth ring road in the south, the Long River in the east, adjacent to the Summer Palace in the north. It includes the south RuYi gate, west gate of the Summer Palace, Back Kiln of the Summer Palace, JingMi canal, the Long River, villages, the South-to-North Water Transfer Channel and proposed "TuanCheng Lake Regulation Pond", the South-to-North Water Transfer Channel garden and modern western suburb tram line etc. We will research, map, and analyze historic, current, and future scenarios of this location in order to propose a new urban relationship between Beijing and the relationship between the various neighborhoods and districts of western Beijing with the this location specifically.

(5)【Course Title】Design Studio II
设计专题二
【Course Code】80001053
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】25 Graduate Students
【Instructor】LI Xiaodong 李晓东
【Course Description】
This 8 weeks course will provide space design training based on architecture or/and urban space design, which should enable students to develop the ability both in theoretical and practical aspect, applying the skills, knowledge and techniques assimilated in the previous architecture course units in an integrated way. This Space Design Studio will consist of lecture courses, seminars, design review, as

well as site survey, providing opportunities to learn from current urban development situation. All topics or issues of the space design studio will be highly appreciated if stemming from the urban public space or architecture in relation with the rapidly urbanized China. The studio system offers a variety of approaches to the process of design, which is considered to be a positive attribute by the students, ensuring scope for debate and discussion. The final assessment is based on the submission and presentation of the space design work.

(6)【Course Title】Academic Frontier of Urban and Rural Planning
城乡规划学术前沿
【Course Code】Y0000111
【Credits】1
【Credit Hours】16
【Semester】Fall
【Capacity】20 Graduate Students
【Instructor】Hok-Lin Leung 梁鹤年
【Course Description】
The lecture will examine how Western cultural concepts explain urban phenomena and planning theories of the West, draw parallels and contrasts from contemporary Chinese contexts, and derive lessons for theory and practice development in China. (5 sessions).
Introduce meta-methods in public policy analysis, comparative study, and aradigmic analysis, and illustrate their application with international examples. (3 sessions).

3. Department of Automation

(1)【Course Title】Network Security
网络安全
【Course Code】70250332
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】20 Graduate Students
【Instructor】LI Jun 李军
【Course Description】
1. IP Networking OSI Layers and Associated Security Issues: (a) L2 Review: Ethernet and VLAN. (b) L3 Review: IP, ICMP and L2 Tunneling (MPLS & BGP, IPSec, PPTP/L2TP, and PPPoE/A). (c) L4 Review: TCP/UDP. (d) L5-L7 Review: HTTP, FTP, DNS, SIP, SSL/SSH, etc. 2. Data Structure and Algorithms: (a) Packet Headers and Checksum. (b) Classification: Hash, Prefix Matching, Trie, etc. (c) Cryptograph: 3DES, AES, MD5, SHA1. 3. Authentication: (a) Privileges and Passwords. (b) RADIUS, LDAP, Windows Domain, Secure ID, SmartCard. 4. Authorization: Firewall (I): (a) L2 Packet Filtering: VLAN and MAC-IP Binding. (b) L3/4 Packet Filtering: Policy Lookup. 5. Authorization: Firewall (II): (a) L4 Stateful Inspection (Session Lookup and Fail-over). (b) L5-L7 Application Proxy. 6. Confidentiality and Integrity: VPN (I) (a) PPP and SSL based VPN, (b) PKI. 7. Confidentiality and Integrity: VPN (II) (a) IKE and IPSec, (b) IPSec VPN Topology 8. Protection and Non-repudiation: NID/PS: (a) Signature Based Solution. (b) Anomaly Analysis. 9. Engineering Issues in Network Security (I): (a) CPU, ASCI and NPU. (b) OS, HID/PS, and Secure Coding. 10. Engineering Issues in Network Security (II): (a) Performance vs. Functionality, (b) Flexibility vs. Usability, (c) Reliability, Scalability and Manageability. 11. Project Discussion. 12. Project Presentation.

(2)【Course Title】Machine Learning
机器学习
【Course Code】80250993
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】30 Graduate Students + 50 undergraduate students
【Instructor】ZHANG Xuegong 张学工
【Course Description】
This is an introductory course on Machine Learning for graduate students and senior undergraduate students of relevant backgrounds. The course will cover the basic concepts of machine learning and pattern recognition, basic mathematical development for major methods that play key roles in the discipline, and

introduction to a broad range of representative machine learning methods and applications.

(3)【Course Title】Performance Evaluation and Optimization for Complex Systems
复杂系统性能评价与优化
【Course Code】90250052
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】30 Graduate Students
【Instructor】JIA Qingshan 贾庆山
【Course Description】
We focus on the modeling and simulation of complex man-made systems in this course, and discuss the fundamental theory and related toolbox for the performance evaluation and optimization. We will discuss the unique position of discrete event dynamic system (DEDS) and other complex man-made systems in modern civilization; clarify the difference from the continuous variable dynamic system; discuss the related mathematics such as probability, queuing theory, and stochastic process; the models of DEDS (both simulation and mathematical models) such as the generalized semi-Markov process; the tools for performance optimization such as ordinal optimization; the sample-path based analysis methods such as perturbation analysis (PA); the optimization and decision making for classical dynamic systems; Markov decision process (MDP); and intelligent optimization algorithms.

(4)【Course Title】Matrix Analysis and Applications
矩阵分析与应用
【Course Code】70250453
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】40 Graduate Students
【Instructor】GAO Feifei 高飞飞
【Course Description】
Matrix Analysis has been broadly used in signal processing， electronic, communications, pattern recognition, neural computation, radar, graph processing and system identification fields, etc. This course targets at providing the necessary matrix knowledge and skills in these areas and improving students' mathematical capability.
The course contents include matrix gradient analysis, singular value analysis, total least square method, matrix characteristic analysis, subspace analysis, projection analysis, etc., and other various related ones like generalized singular value decomposition, extension of total least square, extension of eigenvalue decomposition (generalized eigenvalue decomposition, generalized Rayleigh

quotient, joint diagonalization, quadratic eigenvalue problem, feature analysis, Fourier analysis), subspace analysis theory and method; projection analysis (orthogonal projection and oblique projection), gradient analysis and optimization (especially gradient computation for scalar function over complex vector and complex matrix), sparse representation and compressive sensing. All above contents are critical features making our course different from those provided by other national and international world class universities.

The main teaching approach is lecturing, where students could gain the knowledge of matrix analysis theory and application skills. A large number of enlightening examples will also be provided during the class. Meanwhile, we will help student develop the research capability via literature reading and computer simulations. The students are also encouraged to apply the matrix analysis theory into their respective research fields, trying to solve practical problems in their works.

4. Department of Automotive Engineering

(1)【Course Title】Fundamentals of Lightweight Design
轻量化设计基础

【Course Code】70150133
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】30 Graduate Students
【Instructor】HOU Zhichao 侯之超
【Course Description】

Chapter 1 Introduction (3 class hours)
- motivation of structural lightweight design
- concepts and approaches of lightweight design
- main methods for vehicle lightweight design
- contents and schedule of the classes

Chapter 2 Fundamentals (4.5)
- Typical structures and their models
- Structural elements and their failure modes

Chapter 3 Material Selection for Lightweight Design (7.5)
- Materials for lightweight design
- Indices for material lightweight design
- Structural elements and typical material indices
- Tutorial: Application of a special software for material selection

Chapter 4 Truss and Solid Beams (14)
- Truss
- Engineering beam theory
- Basics of plastic beam
- Tutorial

Chapter 5 Thin-walled Beam and Stiffened Shear Web (16)
- Bending of thin-walled beams
- Torsion of thin-walled beams
- Stiffened shear web
- Tutorial

Chapter 6 Typical Applications of Lightweight Design (3)
- USA and EU: ULSAB program
- Vehicle lightweight design in Japan and South Korea
- Other examples

(2)【Course Title】Automotive Engineering I
汽车工程 I

【Course Code】70150153
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】30 Graduate Students
【Instructor】WANG Xiaofeng 王霄锋

【Course Description】Automotive engineering I focuses on dealing with vehicle performances in their longitudinal direction, i.e., driving and braking performances. The main contents of the course are as follows:

1. The resistance forces to the motion of vehicle, including rolling resistance, aerodynamic drag, upgrade resistance force, and acceleration resistance.
2. The designs and structures of the engines, clutches, hydrodynamic couplings, hydrodynamic torque converters, transmissions, transfercases, driveshafts, differentials, brakes and brake circuits
3. Determination of the vehicle performances, including maximum velocity, maximum slope angle which can be overcome, maximum acceleration.
4. Determination of the fuel consumption of the vehicle.
5. determination of the brake performances of the vehicle.

The students are required to do exercises.

(3)【Course Title】Internal Combustion Engines I
内燃机 I
【Course Code】70150203
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】30 Graduate Students
【Instructor】MA Xiao 马骁
【Course Description】
This course will focus on introducing the working process and the design of the internal combustion engines. This course includes the introduction and the properties of the fuels for internal combustion engines, and the energy efficiency（thermodynamic fundamentals）of internal combustion engines, together with heat transfer in combustion engines which are three of the key chapters. Design of combustion engines, valve train and design elements of combustion engines are the important contents of the combustion engines' design.

(4)【Course Title】Electrochemical Methods: Measurement and Simulation
电化学方法：测量与模拟
【Course Code】70150362
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】30 Graduate Students
【Instructor】Zhang Jianbo 张剑波
【Course Description】
课程大纲：Syllabus of Electrochemical Methods: Measurement and Simulation
Chapter 1 Introduction
Chapter 2 Fundamentals of electrochemistry
Chapter 3 Electrochemical measurement

Chapter 4 Electrochemical simulation
Chapter 5 Application of electrochemical methods in FC
Chapter 6 Application of electrochemical methods in LIB

(5)【Course Title】Alternative Vehicle Propulsion System
车辆新型驱动系统
【Course Code】80150162
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】30 Graduate Students
【Instructor】ZHANG Junzhi 张俊智
【Course Description】
The subject of this lecture series is alternative concepts for vehicle drive-trains. These lectures deal with the different alternative drive systems, such as unconventional types of combustion engines with the consideration of alternative fuels (alcohol, natural gas, and hydrogen), gas turbines, Stirling engines and fuel cells. Furthermore, these lectures discuss the different types of variable transmissions and power split drive trains. Regenerative drives e.g. electric, flywheel and hybrid drives are a main topic of these lectures. Beside the discussion of the different components (hydraulic machines, electric motors, hydraulic pressure accumulators, batteries, flywheels), possible control strategies (integrated engine-transmission management) are deducted, according to the various drive concepts.

(6)【Course Title】Vehicle NVH
汽车 NVH
【Course Code】80150173
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】30 Graduate Students
【Instructor】ZHENG Sifa 郑四发
【Course Description】
Vehicle NVH mainly concerns the fundamentals of acoustic, and principal, analysis and control method of vehicle NVH. Six parts are included in this course: 1) fundamentals of acoustics and audiology, 2) measuring equipment and signal analysis, 3) legistation, measuring regulations and limiting values, 4) drive chain and chassis NVH, 5) body NVH, 6) Psychoacoustics and sound quality.

(7)【Course Title】Fundamentals of Automotive Crash Safety
汽车碰撞安全基础
【Course Code】80150193
【Credits】3

【Credit Hours】48
【Semester】Fall
【Capacity】30 Graduate Students
【Instructor】ZHOU Qing 周青
【Course Description】
This course will systematically introduce the fundamental knowledge, current technologies and research methods in the area of vehicle crashworthiness and occupant and pedestrian protection. The main contents include safety features of automotive body structure, design and analysis of major energy absorbing components, occupant injuries in motor vehicle accidents, occupant restraint systems, pedestrian impact protection, analysis of vehicle structure failure under impact loading, vehicle safety assessment method, etc.

(8)【Course Title】Vehicle Control Engineering
车辆控制工程
【Course Code】70150113
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】30 Graduate Students
【Instructor】LI Keqiang, Li Shengbo 李克强、李升波
【Course Description】
Based on Control Theory and Vehicle Dynamics, this course will present the control strategies, system design and evaluation method to develop vehicle electronic control devices, and introduce the state of the art and perspectives of vehicle control technology. To introduce the concepts and terminology, the stateof-the-art development, and basic principles of various vehicle control systems. Principles，Rather Than Specifics Will be Emphasized Upon completion of this course, students should be able to follow the literature on these subjects and perform independent design, research and development work in this field.

5. Department of Chemical Engineering

(1)【Course Title】Bioseparation Engineering
生物分离工程
【Course Code】70340132
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】30 Graduate Students
【Instructor】LIU Zheng 刘铮教授
【Course Description】
Part I Fundamentals
Chapter 1. Introduction to biotechnology and bioseparation
Chapter 2. Molecular fundamentals
Chapter 3. Chemical engineering fundamentals
Chapter 4. Instrumentation

Part II Unit operations in bioseparation
Chapter 5. Recovery and capturing techniques
Chapter 6. Separation and purification (I) Extraction
Chapter 7. Separation and purification (II) Chromatography
Chapter 8. Separation and purification (III) Electrokinetic separations
Chapter 9. Polishing and product formulation

Part III Process development
Chapter 10. Principles of bioseparation process design
Chapter 11. Process validation and waste management
Chapter 12. Advanced topics

6. Department of Chemistry

(1)【Course Title】Chemistry for Sustainable Society
可持续发展社会的化学
【Course Code】40440301
【Credits】1
【Credit Hours】16
【Semester】Fall
【Capacity】70 Undergraduate Students
【Instructor】WANG Meixiang 王梅祥
【Course Description】
This short course is designed specifically for the chemistry students of Tsinghua Elite Program. It is aimed to guide students to scrutinize the importance and contribution of chemistry to humankind and the development of society. It is hoped that the students, after studying the course, will strengthen their interest in chemistry, improve their innovative capacity, and choose chemistry research as their life-time career. This course will discuss a few key issues of chemistry and sustainability of the economic and social development. The topics include: what challenges we are facing in terms of sustainable development, what chemistry can deliver to ensure enough foods and guarantee food safety; chemistry is the devil causing problems of our living environment, or chemistry is the angel to protect our ecosystem and environment; where we can find enough energy to drive our planet; what are the replacement of the fossil resources for chemical industry and manufacture; what chemistry can contribute to improve the quality of life; and the philosophy and the contents of sustainable chemistry.

(2)【Course Title】Introduction to Computational Chemistry
计算化学导论
【Course Code】40440321
【Credits】1
【Credit Hours】16
【Semester】Fall
【Capacity】70 Undergraduate Students
【Instructor】LI Jun 李隽
【Course Description】
In a time of computer revolution, chemistry has become a science with both experiment and theory due to the rapid developments of applying quantum mechanics and relativity mechanics to fundamental chemistry problems. In this course, we will introduce recent developments in theoretical and computational chemistry and the applications in experimental chemistry research.

7. Department of Civil Engineering

(1)【Course Title】Elasticity and Plasticity
弹塑性力学
【Course Code】70030023
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】40 Graduate Students
【Instructor】CHENG Xiaohui 程晓辉
【Course Description】

(2)【Course Title】Transportation for Tomorrow (C-Campus Course)
未来交通
【Course Code】20030272
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】30 Undergraduate Students
【Instructor】WU Jianping 吴建平
【Course Description】
"Transportation for Tomorrow" course included in Tsinghua-KTH course "Creative Learning" is hosted by both Tsinghua University and KTH. The course is innovative in the teaching mind and approach. Different from the conventional teaching pattern that focuses on transferring knowledge to students, the course is based on exploring and researching by interaction between teachers and students. Students would gather knowledge through discussion in class and self-learning. Teaching group consists of five teachers from Tsinghua – Jianping Wu, Qing Zhou, Runhua Guo, Li Li and Yiman Du – and six teachers from KTH - Niki Kringos, Sebastiaan Meijer, Staffan Hintze, Susanna Toller, Anders Wengelin, Mikael Nybacka. 15 students will be selected from Tsinghua University and KTH respectively. Language capability, capability of independent observation and thinking, teamwork ability constitutes the judging criterion in the selection. The course aims at training the capability of creative learning within this specific teaching environment. Likewise, the course will build a new type channel of communication between teachers and students providing chances for professors and students to communicate with each other. Teaching pattern is mainly made up by discussion. During the course, training of capability of observation, raising questions, analysis and solving question is focused on. In the course, students would be categorized into 5-6 groups. Each group has 5-6 students, including 2-3 students from KTH and 2-3 students from Tsinghua University, and they will have a topic related to future transportation. The course lasts 8 weeks. In first 2weeks, students should raise a question through observation and investigation. In weeks 3-6, the topic will be accomplished by discussion in the whole team. Finally, in

weeks 7-8, seminar and examination in class will be hosted. It's a brand new exploring course and significant in training of creative learning of students.

(3)【Course Title】Structural Mechanics (2)
结构力学（2）
【Course Code】20030142
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】30 Undergraduate Students
【Instructor】ZHONG Hongzhi 钟宏志
【Course Description】
This course is intended to provide the student majoring in civil, architectural and other related areas skills of structural analysis at an intermediate level. It consists of three major topics: Matrix analysis of structures, Plastic limit analysis and dynamic behavior of structures. The matrix analysis part exposes the student to the elementary skills and procedures in large-scale problems that can only be dealt with using computers. The second topic covers the essential concepts in plastic design of structures. In the third topic, emphasis is placed on the dynamic response analysis of discrete parameter (lumped mass) systems. The behavior and elementary skills of dynamic analysis of discrete parameter systems are studied.

(4)【Course Title】Building Materials
建筑材料
【Course Code】40030902
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】30 Undergraduate Students
【Instructor】WEI Ya 魏亚
【Course Description】
This course offers a broad introduction to materials used in civil engineering, including cement, concrete, steel, masonry, asphalt concrete, wood and composites. The characteristics of each type of material are discussed in terms of the following aspects: basic structure and properties of the materials, mechanistic behavior of the material and physical properties, environmental influences, engineering applications etc. Acting as a bridge linking fundamental principles to engineering practice, this course emphasizes on the engineering behaviors of these material systems. Understanding of these behaviors will be approached through detailed examination of the materials' microstructural characteristics and the associated structure performance. The students will derive benefit from this course in terms of fundamental principles, experiences, and skills.

(5)【Course Title】Traffic Analysis and Design

交通分析与交通设计

【Course Code】40030942

【Credits】2

【Credit Hours】32

【Semester】Fall

【Capacity】30 Undergraduate Students

【Instructor】WU Jianping 吴建平

【Course Description】

The course systematically introduces traffic survey methods, road capacity, traffic flow theory, transport modeling, traffic assignments, traffic flow management and traffic simulation theory and technologies, and preliminary introductions of intelligent transport systems, traffic safety and sustainable development of transport. The course will be given with application examples and coursework to deepen and consolidate knowledge, and through reference reading and interactive classroom discussion to increase students' independent thinking and self-learning ability.

8. Department of Computer Science and Technology

(1)【Course Title】Combinatorics and Algorithms Design
组合数学与算法设计
【Course Code】70240384
【Credits】4
【Credit Hours】64
【Semester】Fall
【Capacity】35 Graduate Students
【Instructor】ZHAO Ying 赵颖
【Course Description】
This course covers topics in Combinatorics and Algorithms Design. We comprehensively discuss basic concepts, theories, methods, and instances in Combinatorics while focusing on concepts and ideas. Selected topics include: the Pigeonhole Principle, counting, combinations, Polya counting, recurrence relations and generating functions, graph, and linear programming etc. We also discuss basic mathematics concepts in algorithms design including growth of function, Big-O notations and recurrence relations etc., and basic strategies of algorithms design including search, divide and conquer, and greedy etc. Finally, we show examples of algorithms design in Combinatorics, including basic algorithms on Graph, minimum spanning tree algorithms, and algorithms for linear programming etc.

(2)【Course Title】Process and Methods of Software Project Management
软件项目管理过程与方法
【Course Code】80240543
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】25 Graduate Students
【Instructor】ZHANG Yong 张勇
【Course Description】
At the end of the course, students should understand basic process and methods of software project management, be familiar with the project management tools. During the practice of software project management, they should be able to integrate the process of software project management and the life cycle of software development, and apply related knowledge to the project management systematically. In this way, they can undertake the software management project confidently.

(3)【Course Title】Topics in Advanced Multimedia Technologies
多媒体前沿技术
【Course Code】80240553
【Credits】3

【Credit Hours】48
【Semester】Fall
【Capacity】25 Graduate Students
【Instructor】WEN Jiangtao 温江涛
【Course Description】
Entropy coding: Huffman coding, AC, entropy coding of GG sources, enumerative coding and Tunstall coding - Quantization: scalar and vector quantizations, TCQ and RD optimized quantization - Multimedia compression standards: jpeg, jpeg2000, H.26x, MPEGx - Multimedia streaming: RTP/UDP, HTTP/TCP, error resilience - DRM: crypto introduction, DRM.

(4)【Course Title】Future Internet Architecture
下一代互联网
【Course Code】80240563
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】25 Graduate Students
【Instructor】LI Dan 李丹
【Course Description】
The development of the Internet makes more and more students get interested in related technologies. The Internet is facing regeneration, and the key technologies of new generation Internet are in dire need of spread. The course aims to enable students further understand and master the key technologies (including technical principles and specific realization) of new generation Internet after an overall understanding, and tentatively cultivate students' research ability in this field.

9. School of Economics and Management

(1) 【Course Title】Computer Network
计算机网络
【Course Code】20510082
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】60 Undergraduate Students
【Instructor】GUO Xunhua 郭迅华
【Course Description】
This course provides a comprehensive introduction to the concepts and principles about data communication and computer networking, including architectures, protocols, technologies, hardware, software, and applications. Emphasis is put upon the requirement analysis and design of networking applications in organizations, while topics such as management of communications networks, cost-benefit analysis, and evaluation of connectivity options are covered, so as to help students learn to evaluate, select, and implement different communication options within an organization.

(2) 【Course Title】Public Finance
公共财政学
【Course Code】30510073
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】150 Undergraduate Students
【Instructor】WU Binzhen 吴斌珍
【Course Description】
Public Finance studies the role of the public sector in the economy. In this course, we will study the economic foundations that justify the existence of the public sector, and the economic theory that describes what the role of the public sector should be. We concern when the governments should intervene the economy and how they should do so, including what options they have and what are the effects of the policies. The focus is on the government taxes and spending activities. We will also look at the governments' policies in the reality, and study how the policies affect individual and corporate decision-making and welfare.

(3) 【Course Title】Intermediate Microeconomics
中级微观经济学
【Course Code】30510743
【Credits】3
【Credit Hours】48
【Semester】Fall

【Capacity】250 Undergraduate Students
【Instructor】ZHENG Jie 郑捷 LI Daokui 李稻葵
【Course Description】
The course presents basic theories of microeconomics and its applications. Topics covered include consumer theory, firm theory, market supply and demand, externality and public goods, industrial organization, and general equilibrium. The economic modeling methods and analytical tools are emphasized throughout the course. The purpose of this course is to make students well trained and proficient in analyzing with systematic microeconomics theory. As a core course in economics, this course has been contiguously endeavoring to keep pace with the leading level. The written materials are English mainly while the oral expression is both in English and Chinese. The lectures delivered by Professor will be in English, the corresponding tutorial classes delivered by TAs will be in Chinese and English.

(4) 【Course Title】Corporate Finance
公司金融
【Course Code】30511053-1/2
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】 Undergraduate Students
【Instructor】CHEN Yunling;Tao Shen
【Course Description】
Concepts and analytical techniques of corporate finance. Real-world examples will beintroduced as well. Upon completion of this course, students are expected to be able tounderstand financial statements and cash flows, time value of money, discounted cash flows,stocks and bonds valuation, risk and return, capital budgeting, cost of capital, capitalstructure, etc.

(5)【Course Title】Behavioral Economics
行为经济学
【Course Code】40511223
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】60 Undergraduate Students
【Instructor】ZHENG Jie
【Course Description】
For each topic listed below, we will discuss how behavioral models use psychological foundations to expand upon “standard” economic theory, in order to more accurately capture observed empirical phenomenon in daily life and in the laboratory. The prerequisites for the course are Intermediate Microeconomics and Multivariable Calculus, which are important for

understanding the materials we cover. Knowledge of statistics and econometrics is also helpful.All assignments and exam papers for the course should be written by yourself in English

(6) 【Course Title】Elementary Chinese
初级汉语
【Course Code】60610162
【Credits】2
【Credit Hours】48
【Semester】Fall
【Capacity】 Undergraduate Students
【Instructor】Jian Hou
【Course Description】

(7)【Course Title】Topics on International Accounting
国际会计专题
【Course Code】40510093
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】60 Undergraduate Students
【Instructor】HAO Zhenping 郝振平
【Course Description】
To understand the development of accounting and financial reporting models in the world, and to enable you to evaluate the reasons and evolution of international accounting harmonization and convergence; To provide you with the key technical issues in international accounting area and their impact on financial reporting, such as accounting for foreign currency transactions, translation of foreign financial statements and accounting for changing prices; To understand some management accounting issues in multinational operations, for instance, the establishment of management control and information system, financial risk management, international taxation, and international transfer pricing. Many of the topics in an international accounting course have a domestic counterpart. However, new factors and complications arise in the international arena. Some of these are (1) laws, practices, customs, cultures, and diversity of competitive circumstances; (2) risks associated with fluctuating exchange rates, differential rates of inflation, and unstable property rights; and (3) variations in taxes and tax rates. International accounting discusses issues from the perspective of companies that have internationalized their finance and/or operations. It also has a comparative aspect, comparing accounting across countries. It also deals with convergence of worldwide financial reporting standards. This course is designed to provide you with an understanding of the significant issues in international accounting. The teaching approach will be mainly classroom lectures with some discussions and presentations.

(8)【Course Title】Management Systems Simulation
管理系统模拟
【Course Code】40510193
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】50 Undergraduate Students
【Instructor】WEI Qiang 卫强
【Course Description】
Many analytical models and mathematical tools have been used in business decision to improve the operational efficiency and seize the competitive advantage. Since, however, the real world business situation and environment, regarded as a system, is very complex, which results that the traditional analytical methods and tools cannot fit properly. This course will introduce a new methodology – simulation – into the business management systems. As its name says, in complex systems, where the number of related variables is huge and they are also closely interdependent, simulation method is to mimic the real parameters in computer system, using the time-advance mechanism, to generate the evolutionary results over time. In so doing, after enough replications of simulation, statistically confident results could be derived. Clearly, the computational load is extremely high. But, with mainstream personal computer nowadays, this process could be performed efficiently. In this course, we will cultivate the students with the abilities of modeling, simulation and analysis with computer and software. By the end of the course, the students should: 1. Master the methodology of simulation and can modeling complex business systems; 2. Master the abilities of modeling with EXCEL and ProModel. 3. Cultivate the ability for further simulation analysis, design and implement. To accomplish this global goal, lecturing is far from enough; case programming, modeling and analysis, assignment and Q&A are also important.

(9)【Course Title】Enterprise Resource Planning
企业资源规划
【Course Code】40510992
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】40 Undergraduate Students
【Instructor】YI Cheng 易成
【Course Description】
ERP systems are enterprise-wide information systems that integrate various functional operations and streamline business processes. This course aims to introduce the concepts of ERP systems as well as the application, implementation, and management of ERP. In particular, the course will help you to obtain the

knowledge of ERP at three levels. 1. At the system level. Through hands-on experience with SAP in lab sessions, you will learn SAP commands and functions. You will be able to handle basic business processes in the SAP environment. 2. At the business process level. You will learn how functional operations interact and coordinate to complete business processes and how ERP can enable and facilitate business process integration. 3. At the organizational level. You will be able to recognize and understand organizational and managerial issues associated with enterprise systems, such as planning, vendor evaluation and selection, as well as system implementation.

(10)【Course Title】Financial Management
财务管理
【Course Code】40511093
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】90 Undergraduate Students
【Instructor】JIA Ning 贾宁
【Course Description】
Financial strategies encompass those financial decisions that affect the long-run value of the firm. The objective of this course is to build on the concepts of financial management learned in Corporate Finance (1) and other relevant courses to provide a bridge to understanding the underlying principles behind why these decisions are made and to offer explanations for observed behaviors on the part of financial decision makers. Focus will be placed on developing a comprehensive framework of conceptual knowledge that builds on the principle of value maximization. Capital budgeting, business valuation, investment analysis, capital structure, option theory, risk management, and long-term financing are integral parts of this conceptual framework.

(11)【Course Title】International Business
国际商务
【Course Code】40511202
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】90 Undergraduate Students
【Instructor】XIE Zhenzhen 谢真臻
【Course Description】
International Business differs in important ways from business conducted within national borders. It poses additional challenges but also offers new opportunities. This course focuses on the strategic challenges confronting firms that compete in the global economy. Material from strategic management, economics, organizational behavior, and other related areas are covered. Our objective is to

have an enhanced understanding of the most fundamental question in international business: What determines the success and failure of companies in an international context? We emphasize the use of analytical tools and concepts but provide many real-world examples. Course projects help students develop their research and writing skills. The course is integrative by design, which leads to some overlap with material taught in other courses. The course topics may not follow the chapters of the textbook.

(12)【Course Title】Auditing1
审计学 1
【Course Code】30510393
【Credits】3
【Credit Hours】
【Semester】Fall
【Capacity】
【Instructor】LI Dan
【Course Description】
The course is designed to provide the student with insight about auditing: what it is, why it's important, what it entails, and why users of financial statements should care about it. Its is an introduction to the audit function, audit standards, objectives and procedures, ethical and legal environment, materiality and audit risk, sampling, and reporting.

(13)【Course Title】Environmental and Resource Economics
环境与资源经济学
【Course Code】40511003
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】
【Instructor】CAO Jing
【Course Description】
This course is an introduction of Environmental and Natural Resource Economics. The objective of this course is for students to learn how basic economic theory can be used to understand and analyze environmental pollution and resource degradation problems. The course covers both conceptual and methodological topics and recent applications in China, US and European countries. Examples of local, regional,national and international environmental and natural resource issues are presented and discussed.The first part of this course is an introduction to the basic principles of environmental and resource economics; cost and benefit analysis. In the second part the focus is on environmental economics and policy, including economics of pollution control, valuing the environment, regional and global air pollution, water pollution and so forth. The third part is focused on natural resource economics, both renewable and non-renewable resources. The

last part is on sustainable development and macroeconomicaspect of environmental policy, and Green Accounting.

(14)【Course Title】Financial Institutions
金融机构
【Course Code】30510962
【Credits】
【Credit Hours】
【Semester】Fall
【Capacity】
【Instructor】PANG Jiaren
【Course Description】
A well-functioning financial system is crucial to economic growth and development as it promotes efficient capital allocation, provides risk sharing, and reduces transaction costs. This course aims to help students understand the role of the financial system by focusing on its major components: financial markets and institutions. It will discuss the economic foundations of financial markets and management of financial institutions. It will also introduce the development of China's financial system and compare it with its U.S. counterpart.

(15)【Course Title】Financial Statement Analysis
财务报表分析
【Course Code】30510893
【Credits】3
【Credit Hours】
【Semester】Fall
【Capacity】
【Instructor】LI Dan
【Course Description】
The objectives of this course are to gain a more thorough understanding of financial accounting techniques and to explore the accounting theory underlying such techniques. Assets, revenue recognition, and income items, investments in other companies and stockholders' equity will be covered in this course. Students will also learn how to apply the skills of financial analysis to realistic situations, such as, valuations decisions or forecasting.

(16)【Course Title】Finance Theory
金融学理论
【Course Code】70518023
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】100(10)
【Instructor】SHEN Tao 沈涛

【Course Description】

This course introduces students to the fundamentals and advances of financial theory. Financial success is the ultimate motivation for modern economic activities, which are necessitated by financial resources. The needs of consumers and businesses have been evolving to exhaust the full capacity that the financial system provides. The development and sophistication of the financial system are thus a continual process. Consequentially, financial theory has been experiencing path-breaking advances along with the rapid development in financial practices. These developments are further accelerated by the extensive globalization of financial markets. This course provides an introduction to modern finance theory and its applications within a unified framework. The topics of the course include: (1) theory of capital structure; (2) valuation of assets; (3) theory of interest rates; (4) portfolio theory; (5) asset pricing models; (6) behavioral finance; (7) finance history. Objectives

At the end of this course, a student should be able to: Describe how major global markets for financial securities function and discuss the mechanics of trading stocks, bonds, and options. Explain the function of simple and complex securities and the role of these securities in asset allocation.Assess the risk and expected return for a security or portfolio using relevant historical information and forecasts. Assess ethical considerations that naturally arise during the process of financial management and investment analysis.

(17)【Course Title】Consumer Behavior

消费者行为

【Course Code】80510872

【Credits】2

【Credit Hours】32

【Semester】Fall

【Capacity】45(15)

【Instructor】ZHENG Yuhuang 郑毓煌

【Course Description】

1. The objective of this course is to introduce you to various important topics of consumer behavior, especially in judgment and decision making, and to conduct research in consumer behavior.

2. Each week you will be assigned to read 2~3 articles. Each paper will be presented by one of you. You need to read all the articles carefully and participate actively in the discussions. The focus of the discussion will be on the concepts, findings, and managerial implications.

(18)【Course Title】Strategic Alliance and Cooperative Strategy

战略联盟与合作战略

【Course Code】80514802

【Credits】2

【Credit Hours】32

【Semester】Fall
【Capacity】45(15)
【Instructor】WU Rui 吴蕊
【Course Description】
This course is an elective designed for graduate students in the Master in Management (MiM) program at Tsinghua SEM. Students should have prerequisite knowledge and analytical tools about general business and strategic management.
Alliance and Cooperative Strategy is intended to improve your ability to determine whether, when, and how to execute cooperative strategies as part of your firms' overall strategy. The past thirty years has witnessed an explosion in cooperative activities across firms. As a result, it is likely that, regardless of your career path, you will at some point either work for, help to establish, or compete with cooperative ventures. Managers considering collaborations face a broad range of issues: Should a collaboration interaction be structured as a joint venture, a contractual alliance, or simply an arm's-length contract? When should I prefer an alliance to doing the project entirely in-house and to a merger? How can I best structure and manage this alliance - and what to do to prevent competition with my partner within this alliance? How do I evaluate a prospective partner? Another component of the course goes on to examine the choice between alliance and M&A: When does it make sense to acquire another firm rather than working via contract? What are the challenges in trying to integrate an acquired company?
This course introduces you to the issues and analytical arguments behind these questions, drawing on advances in competitive strategy, organizational economics, and organizational behavior. Whereas it incorporates various theoretical perspectives, the course is designed to focus on the essential issues and problems of business-level cooperative strategy as experienced regularly by managers. The objectives of the course are to provide analytical frameworks and tools that will sharpen your abilities to:

- Recognize and evaluate collaborative opportunities;
- Evaluate potential and current partners;
- Anticipate problems faced by cooperative ventures and to manage these effectively;
- Develop and assess an overall cooperative strategy.

10. Department of Electrical Engineering

(1)【Course Title】Automatic Control Systems
自动控制原理
【Course Code】30220363
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】30 Undergraduate Students
【Instructor】SHEN Chen 沈沉
【Course Description】
Upon completion students should understand the basic concepts in both classical and modern control theory: characteristics of a linear system, linearization, how to build up mathematical models for linear systems in different mathematical forms such as differential equations, transfer functions and state-space equations, be able to do system analysis (stability and performance assessment), master different tools for doing system analysis (classical time domain and frequency domain methods, state space methods), be able to do system synthesis based on different system description using appropriate tools; understand the differences between continuous and discrete-data control systems, effects of sampling rates and quantization, be able to analysis and synthesis a digital control system including stability and performance assessment using time- and frequency-domain methods, be able to design simple digital controllers either directly using discrete-date controller design methods or using continuous controller design method then converting it into a digital one.

(2)【Course Title】Design & Analysis for Electronic Machine System
电子电机设计与分析
【Course Code】40220682
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】30 Undergraduate Students
【Instructor】ZHAO Zhengming 赵争鸣
【Course Description】
The course is about the fundamental theory and design methods of electronic machine system, which covers the definition of electronic machines, the design, performance analysis, transient analysis, and the electromagnetic field analysis of the electronic machines.

11. School of Environment

(1)【Course Title】Sustainability: Environment, Energy and Personal Choices
可持续型社会：环境、能源与行为
【Course Code】40050773
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】20 Undergraduate Students
【Instructor】LU Xi 鲁玺, ZHAO Ming 赵明, WU Ye 吴烨
【Course Description】
With the growing requirement on environmental resources for the development of human society, global environmental problems have become increasingly prominent. A sustainable society involves not only rethinking of personal choices and behaviors, but also reconfiguring the carbon-based energy economy. The challenges posed by regional environmental problems and global climate warming imply a sustainable society would need to gradually reduce its dependence on fossil fuels, especially the coal and oil. This course is intended to explore the theories and methods toward a sustainable society from three perspectives, namely environment, energy and personal choices. The course will be taught in English, aiming at training students to think critically to solve the problems innovatively using a variety of approaches from interdisciplinary perspectives. The course will take advantage of internet technology and multimedia classroom to combine onsite classroom teaching and remote interactive teaching from the University of Washington (UW) led by Dr. Kristina M. Straus. Students from Tsinghua are encouraged to communicate with the UW Students, to collaborate with them on the course projects. The overall goal is to stimulate student interests in learning from both books and practical experiences, and to improve their comprehensive skills of teamwork, communication, critical thinking. This course is divided into two parts. The first one involves students to interact with local and remote teaching teams in class and in their course work. Courses will cover fundamental theories of sustainability, natural capitalism, sustainable food choices, product life cycle analysis, energy consumption, water crisis in the United States, low-carbon economy, development of new energy in China, low-carbon transportation system and other relevant topics. The second part mainly refers to field trip activities either in Beijing or in Seattle.

(2)【Course Title】Biofilms: Fundamentals to Applications
生物膜基础与应用
【Course Code】8005422
【Credits】2
【Credit Hours】32
【Semester】Autumn
【Capacity】25 Graduate Students

【Instructor】ZHOU Xiaohong 周小红 SHI Hanchang 施汉昌
【Course Description】
Biofilms play an important role in the biological wastewater treatment process. This course relies on the fundamentals and hot-topics in biofilm studies, mainly introducing the characteristics, reaction mechanism and mathematical modeling of biofilms, and advances in biofilm studies and applications in wastewater treatment due to the drive functions in the fields of biotechnologies and sensor technologies. This course aims at the graduate students, who have basic backgrounds in the environmental engineering and science. This course will start with an introduction to biofilms, the biodegradation kinetics of biofilms and mass transport mechanism in the biofilms. Subsequently, this course will especially introduce the architecture, population structure and function of biofilms, then introduce the interpretation of biofilm characteristics based on the microelectrode technology. In the end, the course will cover the mathematical modeling of biofilm, its comparison with suspended microorganisms, and biofilm reactors used for wastewater treatment. The major researchers in biofilm studies will be mentioned in this course. Students will be required to do literature investigation aiming at on a selected researcher and/or topic related to biofilms and give a presentation at the end of the course. The course will provide abundant application cases and include a visit to a biofilm wastewater treatment plant.

(3)【Course Title】Fundamentals of Environmental Biotechnology
环境生物技术原理
【Course Code】70050313
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】25 Graduate Students
【Instructor】WANG Hui 王慧
【Course Description】
Recently, environmental biotechnology has become a very important, extremely active and exciting research field. As an important part of environmental science and engineering, environmental biotechnology has produced many important effects on it. The contents of environmental biotechnology involves the principles and applied technology of multiple disciplines, such as microbiology, molecular biology, biochemistry and molecular ecology. The goal of this course is to impart the students the basic knowledge on the important principles and advanced technology of environmental biotechnology, and to help students understand how to make use of environmental biotechnology to the practice of environmental science and engineering. The course of environmental biotechnology comprises three parts which will be carried out in different teaching models. The first part is classroom teaching, which mainly focus on introducing principles, methodology and applications of environmental biotechnology. The second part is academic presentation and discussion basing on literature reading. The third part includes

two times of field visits to help students understand the contents of the course deeply. The total class hours of the course will be 48, in which the first part is 30 hours and the rest parts will be 8 hours respectively. In the first part of course three teaching units were designed. The first unit mainly focuses on introducing principles of environmental microbiology, evolutionary microbiology, microbial ecology, and other disciplines involved in environmental biotechnology. The second unit addresses methodology of environmental biotechnology, which includes stoichiometry, microbial bioenergetics, microbial kinetics and molecular microbiology techniques. The third unit provides a general introduction of some important applications and development of environmental biotechnology with emphasis of typical biological processes in wastewater treatment.

(4)【Course Title】Advanced Water Distribution System and Management
高等管网系统与管理
【Course Code】80050193
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】25 Graduate Students
【Instructor】LIU Shuming 刘书明
【Course Description】
This course focuses on the establishment and application of water distribution network model. Its main contents covers: Introduction to Water Distribution Modelling; Modelling Theory; Assembling a Model; Water Consumption; Data for Modelling; Introduction to EPANET; Calibration Hydraulic Network Models; Using Models for Water Distribution System Design; Water Quality in Distribution System; and Water System Security. This course emphasizes students' capacity of using water distribution models and team-working. All students should complete an assignment in this course. The assignment provides a platform to implement a all-stage model establishment and application. Techniques of data collection, digitization, model calibration and model application will be trained through this assignment. The model application lectures focuses on using a calibrated model for network design and network management.

(5)【Course Title】Advanced Water Supply Engineering
高等给水工程
【Course Code】80050203
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】25 Graduate Students
【Instructor】LIU Wenjun 刘文君
【Course Description】

This course provides the modern theoretical knowledge, engineering application and frontier research to the graduates who have the basic knowledge of water supply engineering. The main contents consist of: physical, chemical and microbiological parameters of water quality and their implications; the principle of water quality standards and its development; reaction, mass transportation, and separation principle; adsorption model and application, the biological treatment of oligo-nutrient source water; the advanced oxidation processes and application, membrane separation; modern disinfection principle and application, the control of biological and chemical stability of water in distribution.

(6)【Course Title】Integrated Solid Waste Management
固体废物综合管理
【Course Code】80050273
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】25 Graduate Students
【Instructor】LU Wenjing 陆文静
【Course Description】
This course puts the engineering and scientific details of solid waste management into the framework of resource management. The basic goal of the course is to provide the knowledge of solid waste management through illustrating of engineering and scientific principals, formulas, data, advanced technologies, and examples of the day-to-day issues associated with the management of municipal solid waste. The main content covers: solid waste generation, characteristics, sorting, collection and transportation, waste recycling, aerobic treatment technology, anaerobic treatment technology, thermo treatment, landfilling, legislation and management system, advanced software execution, arising technology introduction.

(7)【Course Title】Air Pollution Control Technology
空气污染控制技术
【Course Code】80050283
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】25 Graduate Students
【Instructor】WU Ye 吴烨
【Course Description】
This course, Air Pollution Control Technology, primarily focuses on the fundamentals of air pollution control and the typical air pollution control technologies and their engineering practice worldwide. The course is first to discuss topics that are common to all air pollutants, such as the history, characteristics and effects of air pollution, and the laws and regulations for air

pollution control. Prior to targeting to the individual air pollutant, the general philosophies of air pollution control are discussed, including the fate and measurements of air pollutants, combustion fundamentals, and general logistics on designing air pollution control systems and equipment. For each of the following four typical air pollutants, particulate matter, VOCs, NOX, and SO2, each major control technology adapted for that pollutant (e.g., electrostatic precipitators for PM, adsorption for VOCs, etc.) and its engineering practice in China and other countries will be detailed discussed. Further, the course covers a typical source, motor vehicles, which play a unique role in air pollution and contribute significantly to urban air pollution problems. Specifically, the mainstream control technologies of evaporative and tailpipe emissions, and those technologies for future autos (such as alternative fuels and advanced vehicle technologies) will be presented respectively.

(8)【Course Title】Internship/Field practice
专业实践
【Course Code】80050291
【Credits】1
【Credit Hours】16
【Semester】Fall
【Capacity】25 Graduate Students
【Instructor】LI Junhua 李俊华
【Course Description】
The filed practice will provides international graduate students the opportunity to gain experience in environmental science, engineering and management field, and help the students learn how to apply theory and principles to the realities of work situations and to develop and expand professional skills. The international students will have internship in some distinguished research institutes, environmental management authorities, environmental companies, facilities including water supply, waste water treatment, air pollution control, and solid waste treatment, and circular economy park. The students will learn the practical technology and progress of environmental protection in China through the field practice. Finally, the results of field practice will be submitted in hard copy and orally presented.

12. Department of Hydraulic Engineering

(1)【Course Title】Professional English for Water and River Sciences
水利专业英语
【Course Code】70040291
【Credits】1
【Credit Hours】16
【Semester】Fall
【Capacity】40 Graduate Students
【Instructor】WANG Zhaoyin 王兆印
【Course Description】

(2)【Course Title】Hydraulics (2)
水利学（2）
【Course Code】30040393
【Credits】3
【Credit Hours】56
【Semester】Fall
【Capacity】47 Undergraduate Students
【Instructor】LIN Binliang 林斌良
【Course Description】
Open Channel Steady Flow classification, uniform flow, energy equation, specific energy, gradually varied flow, water surface profiles, backwater analysis Rapid varied flow, hydraulic jump, subcritical, critical, supercritical flow. Open Channel unsteady Flow One-dimensional continuity and momentum equations, two-dimensional continuity and momentum equations, the method of Characteristics Hydraulic Structures Weirs, orifices, sluice gates, spillways. Flow through porous media Governing equations, Darcy's law, Flow through porous media finite element method solutions.

13. Department of Industrial Engineering

(1)【Course Title】Engineering Economy
工程经济学
【Course Code】30160152
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】85 Undergraduate Students
【Instructor】ZHU Wanshan 朱万山
【Course Description】

(2)【Course Title】International Logistics
国际物流
【Course Code】40160522
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】30 Undergraduate Students
【Instructor】ZHAO Lei 赵磊
【Course Description】
Discuss and study the issues related to international logistics, understand both the commonalities and differences between international and domestic logistics, and learn to apply these concepts in real world applications.

(3)【Course Title】Quality Engineering
质量工程学
【Course Code】70160023
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】50 Graduate Students
【Instructor】WU Su 吴甦、WANG Kaibo 王凯波
【Course Description】
1. Introduction 2. Quality Function Deployment 3. Statistical Quality Control & Acceptance Sampling 4. Design of Experiments and Taguchi Method

(4)【Course Title】Production Management
生产管理
【Course Code】70160033
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】50 Graduate Students

【Instructor】CHENG Ye 成晔、ZHANG Zhihai 张智海
【Course Description】
Contents: Introduction and Production System, Product and Production Engineering, Material Management, Production Plan, Production Planning, Manufacturing and Assembly Rationization Quality, Information in Manufacturing, Production Organization, Manufacturing Cost.

(5)【Course Title】Ergonomics
工效学
【Course Code】70160613
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】50 Graduate Students
【Instructor】RAO Peilun 饶培伦
【Course Description】
This lecture covers the basic theory of physiology, psychology and management. It will discuss the following topics like system analysis and optimization of the relations among human, computer and environment and so on. That is to say, the working efficiency and product competition can be improved; on the other hand, the comfortable and safety working environment can be realized.

(6)【Course Title】Introduction to Decision Making
决策方法学
【Course Code】70160513
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】50 Graduate Students
【Instructor】ZHAO Lei 赵磊
【Course Description】
Mathematic programming methods: 1. Linear Programming: a) Fundamentals and modeling, b) Simplex method, c) Duality and sensitivity analysis. 2. Transportation and assignment problems. 3. Network optimization models. 4. Dynamic programming. 5. Integer programming basics. 6. Nonlinear programming basics. Decision analysis Probability and statistics: 1. Introduction to probability theory: a) Fundamentals and concepts, b) Conditional probability. 2. Random Variables: a) Distributions, b) Expectation and variance, c) Common distributions. 3. Sampling and estimation: a) Common statistics, b) Confidence intervals, c) Hypothesis tests.

(7)【Course Title】Industrial Practice
工业工程实践
【Course Code】70160591
【Credits】1

【Credit Hours】16
【Semester】Fall
【Capacity】20 Graduate Students
【Instructor】LI Yan 李妍
【Course Description】
This course includes mainly two parts: 1. Manufacturing Industries in China and Industrial Engineering, 2. Business communication under Chinese Culture.

(8)【Course Title】Systematic Product Design and Development
系统化产品设计与开发
【Course Code】80160283
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】50 Graduate Students
【Instructor】CHENG Ye 成晔、ZHANG Wei 张伟
【Course Description】
The objective of this course is to develop the interdisciplinary knowledge and skills required for systematically executing a given design task and to prepare students qualified for engineering work in modern enterprises. In addition, effective communication skills and ability for synthesizing different perspectives of product design are expected to be developed. Students will be exposed to the theories, methodologies and tools assisting product planning and management, project management, cost management for product development, rationalization of design process, variant development, quality assurance for product development. New tools assisting engineering design work will be introduced. Hands-on design experience and skills will be gained and learned through problem sets. Besides regular lectures, weekly exercises, projects and in-class discussion sessions will be held. An understanding of complex design issues in real-world will be developed through a collaborative design and development project throughout the semester.

(9)【Course Title】Systematic Product Design and Development
定量分析
【Course Code】80160393
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】50 Graduate Students
【Instructor】DENG Tianhu 邓天虎
【Course Description】
This course is designed to provide an understanding of probability and statistics. In this course, we cover materials such as discrete and continuous random variable, probability distribution, statistical inference, hypothesis testing, experimental

design and linear regression. We focus on applications in the field of production management and supply chain management.

14. Institute of Interdisciplinary Information Sciences

(1)【Course Title】Hot Topics in Computational Biology
计算生物学热门课题
【Course Code】80470073
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】10 Undergraduate Students, 20 Graduate Students
【Instructor】ZENG Jianyang 曾坚阳
【Course Description】
The course covers research progress and hot topics in Computational Biology and introduces topics including basic computational theory and methods, three-dimensional structure determination and dynamic study of proteins, protein and drug molecular design, Proteomics, and Biology evolution model.

(2)【Course Title】Quantum Electronics and Advanced Atomic Physics
量子电子学和高等原子物理学
【Course Code】80470173
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】10 Undergraduate Students, 30 Graduate Students
【Instructor】Kim Kihwan
【Course Description】
This course provides a practical knowledge of quantum electronics and advanced atomic physics for graduate students who are performing atomic and optical experiments. First, we provide a fairly conventional discussion of Gaussian beams, cavities, nonlinear optics and modulation techniques. Then we seriously discuss the knowledge of atomic structure and atom-photon interaction. Finally we connect them for the amplification of light and spectroscopy for the laser frequency stabilization. A number of very recent developments are discussed, such as frequency metrology using femtosecond lasers, laser cooling and trapping, and Ion traps.

(3)【Course Title】Advanced Quantum Statistical Mechanics
高等量子统计力学
【Course Code】80470154
【Credits】4
【Credit Hours】64
【Semester】Fall
【Capacity】5 Undergraduate Students, 10 Graduate Students
【Instructor】Mircea Trif
【Course Description】

Review of statistical mechanics, Information and Statistical Physics, foundations of quantum statistical mechanics, Quantum Master and Kinetic equations, Quantum irreversibility, Non-equilibrium quantum mechanics, Equilibrium limit theorems, quantum measurement and irreversibility, Fluctuation and dissipation theorems
Thermodynamic limit for quantum mechanical systems, Quantum Phase transitions, Fidelity and information, Symmetries and order parameters, spontaneous symmetry breaking, quantum spin systems, locality in quantum many body systems, Lieb-Robinson bounds, quantum lattice gauge theory, scaling and universality, entanglement and foundations of quantum statistical mechanics, topological quantum order, anions and fusion, conformal field theory, quantum hard drives, equilibration and quantum quenches. Black hole thermodynamics.

(4)【Course Title】Design and Analysis of Algorithms
算法分析与设计
【Course Code】80470032
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】20 Undergraduate Students, 20 Graduate Students
【Instructor】DUAN Ran 段然
【Course Description】
This course is set for junior graduate students, who are expected to have good understandings of mathematics and knowledge in basic theoretical computer science.
The course introduces advanced technologies concerning the design and analysis of algorithm, as students will read theses in the field of algorithm design. It also helps students to determine their future research interests through understandings of algorithm.
Topics covered in this course are: review of basic technologies of algorithm design including divide-and-conquer algorithms and dynamic programming; introduction of the design and analysis of random algorithm and approximation algorithm; introduction of the current research on important issues including linear algorithm, online algorithm, and data structure in computational geometry.
The course is mainly conducted through lectures and series seminars, supplemented by featured discussions. The students are required to take thesis reading exercises and give summary reports, with a view to helping them find their future research interests.

(5)【Course Title】General Physics (2)
普通物理（2）
【Course Code】20470034
【Credits】4
【Credit Hours】64
【Semester】Fall
【Capacity】45 Undergraduate Students

【Instructor】SUN Luyan 孙麓岩
【Course Description】
This course is a follow-up course of General Physics I and for undergraduate students with serious interests in physics and interdisciplinary sciences. The main focus of this course is to cover the most important topics in classical electrodynamics including electrostatics, magnetostatics, Maxwell's equations for electromagnetic fields, and special relativity. This course will emphasize both basic concepts and solving practical problems. After completing this course, students are expected to gain a good understanding of basic classical electrodynamics.

(6)【Course Title】Introduction to Computer Science
计算机入门
【Course Code】30470013
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】60 Undergraduate Students
【Instructor】CUI Xuefeng 崔学峰
【Course Description】
Designed to appeal to a diverse audience, this course examines some of the fundamental ideas of the science of computing. Lectures and hands-on assignments cover a wide variety of topics such as hardware organization, the Internet, computer programming, limits of computing, and graphics. No prerequisite.

(7)【Course Title】Machine learning
机器学习
【Course Code】30470104
【Credits】4
【Credit Hours】64
【Semester】Fall
【Capacity】40 Undergraduate Students
【Instructor】WANG Liwei 王立威
【Course Description】
Machine learning studies how computers can learn from experiences. Combining ideas from theoretical computer science and statistics, researchers have developed many learning methods and their applications to computer vision, bioinformatics, natural language processing etc. are highly successful. Machine learning theory addresses the fundamental problems in learning. It studies the power and theoretical limits of learning. The aim is to provide deep understand of learning and the guidance for the development of practical algorithms.

(8)【Course Title】Algorithm Design
算法设计
【Course Code】30470124

【Credits】4
【Credit Hours】64
【Semester】Fall
【Capacity】50 Undergraduate Students
【Instructor】Li Jian 李建
【Course Description】
This course gives an introduction to the basics of algorithm, common algorithm design techniques, and the analysis of running time (complexity). The main contents include: tools of algorithm analysis, divide and conquer algorithms, dynamic programming, greedy algorithms etc. algorithm design techniques, and NP complete, randomized algorithms, approximation algorithms and other advanced topics.

(9)【Course Title】Linear Algebra
线性代数
【Course Code】20470044
【Credits】4
【Credit Hours】64
【Semester】Fall
【Capacity】55 Undergraduate Students
【Instructor】XUYong 徐勇
【Course Description】
Linear algebra finds wide applications in various fields, such as computer sciences, physics, mathematics and their interdisciplinary fields. This course introduces the basic concepts and techniques of linear algebra. It includes the study of matrices and their properties, linear transformations and vector spaces. Concrete topics include systems of linear equations, row reduction and Echelon form, vector equations, solution sets of a linear equation, linear independence, linear transformation, the matrix of linear transformation, matrix algebra, characterization of invertible matrices, determinants, subspaces, null spaces, column spaces, bases and dimension, rank, eigenvalues and eigenvectors, diagonalization, inner product, etc. By introducing the concepts through concrete examples, students will learn the basic concepts and methods of linear algebra, and their capacity to think from the linear algebra perspective will be systematically trained and enhanced.

(10)【Course Title】Quantum Information
量子信息
【Course Code】40470094
【Credits】4
【Credit Hours】64
【Semester】Fall
【Capacity】40 Undergraduate Students, 5 Graduate Students
【Instructor】MA Xiongfeng 马雄峰
【Course Description】
Quantum Information is a course offered to upper level undergraduate students

(junior or senior students in the Yao Class, physics, EE, and computer science departments) and graduate students. The course will cover many topics at the forefront of the new field of quantum information science, including, for instance, quantum entanglement theory, quantum cryptography, quantum communication theory, quantum computing models, quantum algorithms and complexity theory, quantum error correction and fault-tolerant computation, physical implementation of quantum computation, communication and networks.

(11)【Course Title】Fundamentals of Cryptography
密码学基础
【Course Code】40470024
【Credits】4
【Credit Hours】64
【Semester】Fall
【Capacity】38 Undergraduate Students
【Instructor】WU Wenfei 吴文斐
【Course Description】
The purpose of this unit is to introduce the basic concepts of modern cryptography. We start this tour by a very brief introduction to classic cryptography, and main issues related to the distribution of digital content such as confidentiality, integrity and non-repudiation. After a short introduction to the preliminaries, we will show several equivalent cryptographic primitives and their reductions to each other. Privacy issues and solutions are discussed in the context of modern private-key and public-key cryptography. Next, we will review tools allowing authentication of digital content using hash function and digital signatures. The presented constructions are building blocks for designing secure systems and protocols for real-world applications. Attacks and security analysis of the cryptographic schemes and protocols will also be discussed.

(12)【Course Title】Network Science
网络科学
【Course Code】40470104
【Credits】4
【Credit Hours】64
【Semester】Fall
【Capacity】45 Undergraduate Students
【Instructor】Chenye Wu
【Course Description】
Network science is a new and emerging scientific discipline that examines the interconnections among diverse physical or engineered networks, information networks, biological networks, cognitive and semantic networks, and social networks.In this course, we examine the many facets of internet from the algorithmic perspective, including for instance the mathematical modeling of large-scale networks, information retrieval algorithms for massive data sets, algorithmic game

theory and electronic commerce. Specific topics include small world phenomena, power law distributions, rank aggregation, web crawling, hubs and authorities, clustering large data sets, streaming algorithms, network routing, Nash equilibrium, market clearing, mechanism design, auction theory, social networks, etc.

(13)【Course Title】Abstract Algebra
抽象代数
【Course Code】20470054
【Credits】4
【Credit Hours】64
【Semester】Fall
【Capacity】40 Undergraduate Students
【Instructor】DENG Dongling 邓东灵
【Course Description】
Abstract algebra studies fundamental algebraic structures of groups, rings and fields, etc. It is the foundation of modern mathematics and has broad and vital applications across different disciplines including computer science, physics, and chemistry. In this course, the students will learn the basic theory of groups, rings and fields, including subgroups, groups' actions, Sylow theorems, homomorphisms and isomorphism, the fundamental homomorphism theorem, Cauchy's theorem, the fundamental theorem of finitely generated groups, polynomial rings, quotient rings, ideas, the Chinese remainder theorem, Euclidean domains; principal idea domains; unique factorization domains; field extension, algebraic extensions; splitting field, fundamental theorem of algebra, and Galois theory, etc. In addition, this course will also introduce the basics of lattices and Boolean algebras.

(14)【Course Title】Artificial Intelligence: Principles and Techniques
人工智能：原理与技术
【Course Code】40470243
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】38 Undergraduate Students
【Instructor】ZHANG Chongjie 张崇洁
【Course Description】
This course will introduce the basic ideas and techniques underlying the design of intelligent computer systems. Specific topics include search, constraint satisfaction, game playing, graphical models, machine learning, Markov decision processes, and reinforcement learning. The main goal of the course is to equip students with the tools to tackle new AI problems you might encounter in life and also to serve as the foundation for further study in any AI area you choose to pursue.

(15)【Course Title】Artificial Intelligence: Principles and Techniques
探索性数据分析

【Course Code】40470253
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】40 Undergraduate Students
【Instructor】CUI Xuefeng 崔学峰
【Course Description】
Exploratory data analysis (EDA) is an approach to analyzing data sets to summarize their main characteristics, often with visual methods. A statistical model can be used or not, but primarily EDA is for seeing what the data can tell us beyond the formal modeling or hypothesis testing task. This course introduces a systematic approach to EDA with multiple applications of machine learning and deep learning algorithms. Moreover, students will be required to implement such applications using scikit-learn, TensorFlow, Hadoop, and other popular packages.

(16)【Course Title】Artificial Intelligence: Principles and Techniques
量化经济学
【Course Code】40470274
【Credits】4
【Credit Hours】64
【Semester】Fall
【Capacity】45 Undergraduate Students
【Instructor】YU Yang 于洋
【Course Description】
This course is designed to prepare the students with the computer science major the insight and knowledge for studying the frontier interdisciplinary problems involving economics and computer science. The booming of data analytics and AI technologies has fundamentally changed many markets and led to three types of new challenges. 1. Developing causality inference techniques based on big data. 2. Developing algorithm for the mechanism designs of the complex markets. 3. Developing the theory and techniques for regulating the algorithm used in the markets. To answer the above questions, researchers must have the intuition and knowledge of both economics and computer science and be able to capture the interdisciplinary insight. The course includes three parts: 1. the foundation of economical and corresponding algorithmic models, which introduces the choice theory, consumer theory, production theory, and market theory by comparing them with the corresponding algorithmic models. 2. The application of the statistic learning and mining tools in economics will be introduced and compared with the econometric models. 3. Introduction about the frontier research about the above three questions.

15. International Chinese Language and Culture Center (ICLCC)

(1)【Course Title】Elementary Chinese
初级汉语
【Course Code】60610162 (8)
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】15 Undergraduate Students, 15 Graduate Students
【Instructor】Zhang Yi 张怡
【Course Description】
For Exchange Students (Beginner).

(2)【Course Title】Elementary Chinese
初级汉语
【Course Code】60610162 (9)
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】15 Undergraduate Students, 15 Graduate Students
【Instructor】Zhang Yi 张怡
【Course Description】
For Exchange Students (Beginner).

16. Department of International Relations

(1)【Course Title】Ancient Chinese Thought & Modern Rising
中国古代外交思想
【Course Code】80615412
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】35 Graduate Students
【Instructor】YAN Xuetong 阎学通
【Course Description】

(2)【Course Title】Research Design and Writing
研究设计与编写
【Course Code】80700242
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】35 Graduate Students
【Instructor】YAN Xuetong 阎学通
【Course Description】

(3)【Course Title】The Politics of Israel and the Middle East
以色列与中东政治
【Course Code】80700832
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】35 Graduate Students
【Instructor】CHEN Qi 陈琪
【Course Description】

(4)【Course Title】Contemporary Theories in International Politics
当代国际关系理论
【Course Code】70612872
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】35 Graduate Students
【Instructor】ZHANG Chuanjie 张传杰
【Course Description】

(5)【Course Title】Theory and Practice of Chinese Foreign Policy
中国对外政策

【Course Code】80615112
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】35 Graduate Students
【Instructor】SUN Xuefeng 孙学峰
【Course Description】

(6)【Course Title】Overview of International Energy and Environment Governance
国际能源与环境治理概论
【Course Code】80700602
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】35 Graduate Students
【Instructor】WANG Tao 王韬
【Course Description】

(7)【Course Title】China and Developing World
中国与发展中国家
【Course Code】80700212
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】35 Graduate Students
【Instructor】TANG Xiaoyang 唐晓阳
【Course Description】

(8)【Course Title】Financial Economics and Chinese Financial Markets
金融经济学与中国金融市场
【Course Code】80700612
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】35 Graduate Students
【Instructor】TANG Ke 汤珂
【Course Description】

17. School of Journalism and Communication

(1)【Course Title】Corporate Strategies: Case Studies of Chinese and Global Companies
公司策略个案报道

【Course Code】70670182
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】40 Graduate Students
【Instructor】Lee J. Miller
【Course Description】
The course will primarily be taught by use of case studies of important multi-national corporations. These cases will be provided to students.

(2)【Course Title】Economics and Accounting Basics for Journalists
新闻记者经济学与会计学基础

【Course Code】70670253
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】40 Graduate Students
【Instructor】HANG Min 杭敏
【Course Description】
This course gives an introduction to principles and basic theories of economics and accounting. It aims at providing students new perspectives and greater understandings about economics and accounting, social activities and financial news reporting. The course instructor will review the history and development of economics and accounting, introduce fundamental theories and analytical tools of macroeconomics and microeconomics. The instructor will also use cases, excerpts from newspapers, articles written by prominent economists for discussion. These methods, together with the brief introductions, will show how basic economic theories can be applied and accounting practices can be understood.

(3)【Course Title】Introduction to Mass Communications and Society in Contemporary China 当代中国大众传媒与社会

【Course Code】80670513
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】30 Graduate Students
【Instructor】DAI Jia 戴佳
【Course Description】

1. Mass Communications in China: Origin, Nature and A Very Brief History. 2. Major Chinese Media Institutions. 3. International Communication Strategies of China. 4. Propaganda, Thought Work and Psychological Operations. 5. Advertising, Public Relations for Transnational Corporations in China. 6. Practical Skills and Case Studies.

(4)【Course Title】News Writing and Multi-media Reporting
新闻写作与多媒体报道
【Course Code】80670793
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】40 Graduate Students
【Instructor】
【Course Description】
This course contains two main modules: news writing and multi-media reporting. In the news writing module, students are trained with basic knowledge of writing and reporting, with a focus on business news. In the multi-media reporting module, students are trained with basic skill of applying multi-media devices for business report.

(5)【Course Title】Business News Writing and Editing
财经新闻写作与编辑
【Course Code】80670803
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】40 Graduate Students
【Instructor】
【Course Description】
This course focuses on the business news writing and editing. The tutor will provide students basic knowledge and skills of news writing and editing. Cases will be used in this course to illustrate how business news are presented. Students will also get opportunities to listen to lectures from industrial practitioners.

(6)【Course Title】English News Reporting and Writing
英语新闻采写
【Course Code】80670862
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】35 Graduate Students
【Instructor】SI Jiuyue 司久岳
【Course Description】

This course teaches fundamental knowledge and skills in English reporting and writing with stress on lead writing and inverted pyramid structure. It also introduces other news styles from AP and Xinhua News Agency. This course prepares students for further development in advanced English news writing.

(7)【Course Title】China-Korea Dialogue
中韩对话
【Course Code】00670313
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】23 Undergraduate Students
【Instructor】CAO Shule 曹书乐
【Course Description】

18. School of Law

(1)【Course Title】The Law of the World Trade Organization
世界贸易组织法
【Course Code】40661373
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】10 Undergraduate Students
【Instructor】LV Xiaojie 吕晓杰
【Course Description】
Economic interdependence between countries and across production chains continue to grow. In this context, stable rules on international trade are key. This course focuses on the rules established under the World Trade Organization (WTO) as well as selected regional trade agreements. What are the benefits and risks of trade liberalization from legal, economic and political perspectives? How can trade liberalization go hand in hand with pursuing public policy goals such as protecting the environment and human rights ("non-trade concerns") or promoting the economic development of poor countries? The course will offer an in-depth, practical knowledge of substantive WTO law drawing heavily on case law from dispute settlement practice. It will address the basic principles of trade in goods and trade in services as well as more specific WTO agreements on, for example, health measures, subsidies, trade remedies and intellectual property rights. The course will also focus on the unique WTO mechanism for the settlement of trade disputes, and especially on how it balances trade liberalization with non-trade concerns as well as how it copes with increasing trade tensions between OECD countries and emerging economies like Brazil, China, India and Russia.

(2)【Course Title】Comparative Corporate Governance
比较公司治理
【Course Code】40661512
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】10 Undergraduate Students
【Instructor】TANG Xin 汤欣
【Course Description】
This course is designed to familiarize students with company and securities laws and underlying policies in China, with an emphasis on the corporate governance structure of publicly-held companies. The course focuses on important governance issues such as controlling shareholders, board of directors, affiliated transactions, domestic and cross-border takeovers. To this end, it also covers securities and investment regulations, such as listing requirements, mandatory disclosure and foreign investment restrictions in the country. In the beginning of

the class, an overview of the regulatory framework and market conditions in Mainland China will be conducted. The other part of the class will be divided into the following units, each in three or four hours: I. Controlling Shareholders, Related-Party Transactions and

(3)【Course Title】International Law
国际法研究
【Course Code】70660113
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】10 Graduate Students
【Instructor】JIA Bingbing 贾兵兵
【Course Description】

(4)【Course Title】International Dispute Settlement
国际争端解决
【Course Code】70660622
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】10 Graduate Students
【Instructor】JIA Bingbing 贾兵兵
【Course Description】
The topic of dispute settlement is a combination of doctrine and practice, which shows, by way of examining the state of research and practice, the way in which international law functions effectively. The course covers the following themes: 1) history of dispute settlement in international relations; 2) diplomatic or political methods; 3) arbitration; 4) judicial means; 5) the role of international organizations; 6) special regimes in the law of the sea, WTO,

(5)【Course Title】New Topics of International Economic Law
国际经济法前沿问题
【Course Code】80660542
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】10 Graduate Students
【Instructor】Jane Yolande Willems
【Course Description】

(6)【Course Title】Current Issues on Economic Law
经济法前沿问题
【Course Code】80660582

【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】10 Graduate Students
【Instructor】Jane Yolande Willems
【Course Description】

(7)【Course Title】Case Study
案例分析
【Course Code】80660792
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】10 Graduate Students
【Instructor】Jane Yolande Willems
【Course Description】

(8)【Course Title】Knowledge Property and Law
外请学者法学专题讲座
【Course Code】80660851
【Credits】1
【Credit Hours】16
【Semester】Fall
【Capacity】10 Graduate Students
【Instructor】ZHANG Yuejiao 张月姣
【Course Description】

(9)【Course Title】Chinese Basic for Lawyers
中国法律汉语
【Course Code】80661472
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】20 Graduate Students
【Instructor】LI Yanhui 李燕辉
【Course Description】
This lecture is mainly introduced the Chinese view of the law proper nouns, that make students learn some law proper nouns upon the Chinese study. It will help them to catch the meanings of Chinese law deeply, and this is the basic and supplementary of LL.M programme courses.

(10)【Course Title】Chinese Basic for Lawyers
中国法律汉语
【Course Code】80661472

【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】20 Graduate Students
【Instructor】LI Yanhui 李燕辉
【Course Description】
This lecture is mainly introduced the Chinese view of the law proper nouns, that make students learn some law proper nouns upon the Chinese study. It will help them to catch the meanings of Chinese law deeply, and this is the basic and supplementary of LL.M programme courses.

(11)【Course Title】Chinese Civil Procedure and the Conflict of Laws
中国民事诉讼与法律冲突法
【Course Code】80661763
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】20 Graduate Students
【Instructor】CHEN Weizuo 陈卫佐
【Course Description】
This course provides succinct explanations of essential issues, fundamental principles and particular institutions in Chinese civil procedure and the conflict of laws. Its main objective is to provide international students with basic knowledge of Chinese civil procedure and the conflict of laws. Focus is directed toward the Civil Procedure Law of the People's Republic of China (last modifications entered into force on 1 January 2011) and the Chinese Statute on the Application of Laws to Civil Relationships Involving Foreign Elements of 28 October 2010 (entered into force on 1 April 2011).

(12)【Course Title】Foreign Patent Law
外国专利法
【Course Code】80661773
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】10 Graduate Students
【Instructor】Randall R. Rader
【Course Description】
This course is an essential course for the students majoring in international intellectual property law. This course will cover all main topics in patent law of a specific country or region (for example, the United States or Europe), such as the subject matter test, utility, novelty, inventiveness, sufficient disclosure, ownership of inventions, patent infringement, doctrine of equivalents, indirect infringement, remedies, etc.

(13)【Course Title】Foreign Trademark Law
外国商标法
【Course Code】80661793
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】10 Graduate Students
【Instructor】Frederick Willem Mostert
【Course Description】
This course is an essential course for the students majoring in international intellectual property law. This course will cover all main topics in trademark law of a specific country or region (for example, the United States or Europe), such as introduction to trademark, subject matter of trademark, distinctiveness requirement, acquisition of trademark, loss of trademark, trademark infringement, fair use, remedies, etc.

(14)【Course Title】The System and International Arbitration in China
中国仲裁制度与中国国际仲裁
【Course Code】80661822
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】10 Graduate Students
【Instructor】TAO Jingzhou 陶景洲
【Course Description】
This course will discuss the trend and problems of developing international commercial arbitration in China mainland, as well as domestic arbitration legislation and related cases. Lectures will be given by practitioners in international commercial arbitration in the region who will share with the students the issues arising in their field of practice. Arbitration rules in various arbitration institutions will be covered.

(15)【Course Title】Basic Concepts of International Arbitration
国际商事仲裁的基本理论
【Course Code】80661832
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】10 Graduate Students
【Instructor】Gary Born
【Course Description】
The course would provide an overview of the features of international arbitration. Basic concepts from arbitration agreement, jurisdiction of the tribunal, the

arbitration process, and the award will be covered. The objective of the module is to provide the students with a comprehensive understanding of the core concepts of international commercial arbitration.

(16)【Course Title】International Electronic Commerce Law
国际电子商务法
【Course Code】80661893
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】10 Graduate Students
【Instructor】Jane K. Winn
【Course Description】
This comparative and international law course will provide background information on electronic commerce law developments in the U.S., EU and PRC. The impact of information technology innovations will be considered with regard to contract law, payments law, trade practices law, regulation of advertising, duty to secure computer networks and personal information, and national court jurisdiction and choice of law problems. The influence of different national regulatory cultures on e-commerce law in global and national markets will be considered. Intellectual property law issues will be considered whenever relevant, including patent, trademark, copyright and trade secret law.

(17)【Course Title】Investment Arbitrations
投资仲裁专题研究
【Course Code】80661953
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】10 Graduate Students
【Instructor】Andrea K. Bjorklund
【Course Description】
Description Investment arbitration conducted under the UNCITRAL rules or under the auspices of ICSID is increasingly being invoked in relation to disputes involving investor and states. This course will provide an overview of investment law, and special features in Bilateral Investment Treaty and procedures and practice of ICSID. An overview of WTO disputes resolution procedures will also be presented. 1. Overview of UNCITRAL Arbitration Rule and ICSID Rules 2. Overview of investment law 3. Special features in Bilateral Investment Treaty 4. Special features in procedures of ICSID 5. Special features in practice of ICSID 6. Overview of WTO dispute resolution procedures

(18)【Course Title】UNCITRAL Model Law and Arbitration Rules
联合国国际贸易法委员会示范法与仲裁规则

【Course Code】80661963
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】10 Graduate Students
【Instructor】Jane Yolande Willems
【Course Description】
The course will discuss the most widely adopted principles and rules in international arbitration. The Model Law was promulgated by UNCITRAL in 1985 and the new Arbitration Rules in 2010.

(19)【Course Title】Chinese Criminal Law and Criminal Procedure Law
中国刑法与刑事诉讼法
【Course Code】80669062
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】10 Graduate Students
【Instructor】YI Yanyou 易延友
【Course Description】

19. School of Life Sciences

(1)【Course Title】Introduction to Life Sciences
现代生物学导论
【Course Code】10450072
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】24 Undergraduate Students
【Instructor】YANG Yang 杨扬
【Course Description】
This introductory course includes the fundamental principles of biochemistry, genetics, molecular biology, and cell biology. Biological function at the molecular level is particularly emphasized and covers the structure and regulation of genes, as well as, the structure and synthesis of proteins, how these molecules are integrated into cells, and how these cells are integrated into multicellular systems and organisms. In addition, each version of the subject has its own distinctive material. All these knowledge are applied to more advanced subjects, like immunology, neurobiology, endocrinology and human behavior. This course also focuses on the exploration of current research in cell biology, immunology, neurobiology, genomics, and molecular medicine.

(2)【Course Title】Microbiology
微生物学
【Course Code】30450263
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】180 Undergraduate Students
【Instructor】CHEN Guoqiang 陈国强
【Course Description】
Microbiology is a compulsory course for students in biology department. This course covers multiple disciplines in microorganism, molecular biology, biochemistry, immunology and microbial diseases. Students taking this course will learn systematic knowledge of microorganism, as well as basic experimental skills. The most popular book Biology of Microorganisms for North American college students is used in this course. Biology of Microorganisms will be updated every two years. New knowledge and technique in microbiology will be added in each update. It is very helpful for student to improve their knowledge and scientific understanding of microbiology.

(3)【Course Title】Biochemistry (2)
生物化学（2）
【Course Code】30450444 (1)

【Credits】4
【Credit Hours】64
【Semester】Fall
【Capacity】140 Undergraduate Students
【Instructor】LI Zhen 李珍
【Course Description】
Biochemistry II is divided into two parts. The first part, which include Chapter 13-23, is bioenergetics and metabolism. The second part, which include Chapter 24-27, is information pathways.

(4)【Course Title】Biochemistry (2)
生物化学（2）
【Course Code】30450444 (2)
【Credits】4
【Credit Hours】64
【Semester】Fall
【Capacity】142 Undergraduate Students
【Instructor】LI Zhen 李珍
【Course Description】
Biochemistry II is divided into two parts. The first part, which include Chapter 13-23, is bioenergetics and metabolism. The second part, which include Chapter 24-27, is information pathways.

(5)【Course Title】Molecular Basis of Human Diseases
重大疾病的分子机制
【Course Code】40450263
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】80 Undergraduate Students
【Instructor】LI Peng 李蓬
【Course Description】
This course aims to provide students with in-depth knowledge of the basic mechanisms of common human diseases such as cancer, diabetes, obesity, atherosclerosis, Alzheimer's disease etc., and to prepare them for future translational research. The course focuses on the current molecular mechanisms underlying the pathogenesis of each disease. There will be extensive discussion on results from current cutting-edge research. Prospective students should have basic knowledge of biochemistry, molecular and cell biology and immunology before registering for this course. Brief knowledge on human physiology and the pathogenesis of each disease will be introduced but students are expected to read extensive reference paper and textbook to understand the content of the lecture.

20. School of Materials Science and Engineering

(1)【Course Title】Engineering Materials
工程材料
【Course Code】20350042 (4)
【Credits】2
【Credit Hours】36
【Semester】Fall
【Capacity】20 Undergraduate Students
【Instructor】SHAO Yang 邵洋
【Course Description】

(2)【Course Title】Electron Microscopy
电子显微分析
【Course Code】40350033
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】125 Undergraduate Students
【Instructor】ZHANG Xiaozhong 章晓中
【Course Description】
The mechanical, physical and chemical properties of materials are determined by the microstructure, phase and composition of the materials. Electron microscopy is used to know the microstructure, phase and composition of the materials in a small area by use of the information generated by the interaction of electron and materials.

21. Department of Mechanical Engineering

(1) 【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.

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

【Course Code】70120233

【Credits】3

【Credit Hours】48

【Semester】Fall

【Capacity】35 Graduate Students

【Instructor】ZHAO Jingshan 赵景山

【Course Description】

This lecture is opened particularly for Tsinghua-Aachen Dual Master Degree Program in mechanical engineering. But it is also opened for all postgraduate students in Tsinghua University.

(3)【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】Fall

【Capacity】10 Undergraduate Students, 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.

(4)【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】Fall

【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 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.

22. School of Medicine

(1)【Course Title】Principles of Pharmacology
药理学原理
【Course Code】34000433
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】30 Undergraduate Students
【Instructor】XIAO Bailong 肖百龙
【Course Description】

(2)【Course Title】Management on Public Health Services
卫生事业管理
【Course Code】74000283
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】10 Undergraduate Students, 50 Graduate Students
【Instructor】LIU Tingfang 刘庭芳
【Course Description】
Management on Public Health Servicesis a subject that explores the development rule of health service, the allocating mechanism of health resource, health policy in step with the situation of China, organization management or work method, and the experiences from other countries based on the theory, method and technology of modern management science to improve the people's health status. This course covers the framework of the health organization, health resource management, health policy analysis, health insurance system and all kinds of health affairs.

(3)【Course Title】Epidemiology
流行病学
【Course Code】74000293
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】10 Undergraduate Students, 50 Graduate Students
【Instructor】ZHANG Linqi 张林琦
【Course Description】
Epidemiology is a population level research on diseases and health science. Course content includes general and special theory. Its general theory describes the basic concepts, basic knowledge and general theory of the Epidemiology. The special part aims to the introduction on the application of epidemiology in disease prevention and control, mainly involving large current human health hazard of infectious diseases and chronic non-infectious diseases, such as cardiovascular

diseases, cancer, the respiratory system and the digestive system diseases, sexually transmitted diseases, AIDS, and injuries etc.

(4)【Course Title】Health Communication
健康传播
【Course Code】74000373
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】10 Undergraduate Students, 50 Graduate Students
【Instructor】LI Xiguang 李希光
【Course Description】
This course gives a firm foundation in planning and delivering messages and understanding health communications to create higher levels of health literacy within a society as a means to inform and influence individual, community and government decisions that enhance health.

23. Department of Microelectronics and Nanoelectronics

(1)【Course Title】Integrated Circuit Fabrication Processes
微电子工艺技术
【Course Code】30260112
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】40 Undergraduate Students
【Instructor】WU Huaqiang 吴华强
【Course Description】
Integration density and performance of digital and analog integrated circuits have undergone an astounding revolution in the last few decades. Although innovative circuit and system design can account for some of these performance increases, technology has been the main driving force. This course will examine the basic micro fabrication process technologies that have enabled the integrated circuit revolution and investigate newer technologies. The goal is to first impart a working knowledge of the methods and processes by which micro and nano devices are constructed, and then teach approaches for combining such methods into process sequences that yield arbitrary devices. Although the emphasis in this course is on transistor devices, many of the methods to be taught are also applicable to MEMS and other micro-devices. This course is designed for students interested in the physical bases and practical methods of silicon VLSI chip fabrication, or the impact of technology on device and circuit design.

(2)【Course Title】Digital Integrated Circuit Analysis and Design
数字集成电路分析与设计
【Course Code】40260173
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】40 Undergraduate Students
【Instructor】LIU Leibo 刘雷波
【Course Description】
Based on the knowledge of digital circuit and logic design and semiconductor devices, this course is dedicated in introducing the fundamental knowledge and technologies of the digital integrated circuit analysis and design, therefore make a good preparation for the following corresponding courses.

(3)【Course Title】Communication Systems and Circuits
通信系统与电路
【Course Code】40260223
【Credits】3
【Credit Hours】48

【Semester】Fall
【Capacity】40 Undergraduate Students
【Instructor】LI Yugen 李宇根
【Course Description】
This course gives insights into analog/digital communication systems with practical circuit design examples. Students are expected to learn both system and circuit design perspectives in modern communication IC design.

(4)【Course Title】Introduction to Quantum Information Science
量子信息学引论
【Course Code】40260262
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】35 Undergraduate Students, 5 Graduate Students
【Instructor】CHEN Wei 陈炜
【Course Description】
This course will introduce the main ideas and techniques of the field of quantum computation and quantum information. One will learn the background material in computer science, mathematics and physics necessary to understand quantum computation and information. Latest progress in quantum information process will be introduced and discussed as well.

24. Department of Physics

(1)【Course Title】Physics (2)
大学物理 (2)
【Course Code】10430354
【Credits】4
【Credit Hours】64
【Semester】Fall
【Capacity】180 Undergraduate Students
【Instructor】BI Kaijie 毕楷杰
【Course Description】

(2)【Course Title】General Relativity
广义相对论
【Course Code】30430094
【Credits】4
【Credit Hours】64
【Semester】Fall
【Capacity】40 Undergraduate Students
【Instructor】BI Kaijie 毕楷杰
【Course Description】

25. School of Social Sciences

(1)【Course Title】The Principles of Area Studies
地区研究
【Course Code】30700242
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】30 Undergraduate Students
【Instructor】CHEN Maoxiu 陈懋修
【Course Description】
This course will focus on area studies research with a particular emphasis on Latin America. In particular it will touch on the politics, economics and social problems both in historical and contemporary Latin America. The course will also pay special attention to Latin America's relations with China and the United States.

26. Department of Thermal Engineering

(1)【Course Title】Numerical Methods in Heat Transfer
计算传热学
【Course Code】80140032
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】25 Graduate Students
【Instructor】David M. Christopher
【Course Description】
Course Objectives:
* To study numerical methods used for solving the Navier-Stokes equations and the energy equation for laminar and turbulent flow in various geometries.
* To introduce widely-used commercial software used to solve the Navier-Stokes and energy equations (Fluent)
Course syllabus:
I. Types of Governing Equations and Boundary Conditions
II. Conduction Heat Transfer
A. Steady State One-Dimensional Conduction Finite Difference Concepts
B. Two-Dimensional Conduction Finite Difference Concepts
C. Boundary Fitted Coordinates
D. Transient Conduction
E. Commercial Heat Transfer Software, Fluent
F. Grid generation with Gambit
III. Convection Heat Transfer
A. Governing Equations
B. Turbulence
C. Natural Convection Heat Transfer
D. Convective Heat Transfer Analyses using Fluent
E. Convergence considerations
IV. Advanced Topics
Radiation
Two-Phase Flow (VOF method)
Porous Media
Periodic Flows (turbomachinery)
Grading:
30% Homework
30% Research project
40% Final exam

(2)【Course Title】Principles of Coal Combustion Pollutant Formation and Control
燃煤污染形成和控制原理
【Course Code】80140072

【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】25 Graduate Students
【Instructor】ZHUO Yuqun 禚玉群
【Course Description】
Coal is the most important primary energy source in China. Its related pollution is also one of the biggest challenges in environment protection in China and even the world. This course covers all the major pollutants formed during coal combustion, including SO2, NOx, particulate matters, trace elements, and CO2, and focuses on:
the environmental impacts of each pollutant; the fundamentals of pollutant formation in and after coal combustion; the mechanisms of pollutant removal and corresponding emission control technologies; the pros and cons of each technology in application; and, the future trends of emission control;
The aim of the course is to give students a comprehensive yet in-depth view on the environment protection efforts made by Chinese power industry.

(3)【Course Title】Data Processing in Thermal Engineering
热工过程测试数据处理
【Course Code】80140112
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】12 Graduate Students
【Instructor】Wang Zhe 王哲
【Course Description】
The course will provide an introduction for the data processing methods used in thermal engineering measurement. The general outline of the course is as following:

- Introduction
- Transform
- Fourier Transform
  - ✧ Continuum Fourier Transform
  - ✧ Discrete Fourier Transform
  - ✧ Fast Fourier Transform
- Radom Signal Processing
- Analysis of Variance
- Multi-variate linear regression
- Artificial neural network
- Wavelet Transform
- Orthogonal Design
- Partial Least Square

(4)【Course Title】Flame and Gas Combustion
火焰与气体燃烧
【Course Code】80140173
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】15 Graduate Students
【Instructor】ZHANG Hai 张海
【Course Description】
This course is on combustion science and technology, focusing on the flame and gas combustion. It covers and mathematically describes in detail various fundamental flame phenomena. The course not only covers the basic laws and phenomena related to chemical reaction, reaction rate and path，but also illustrates the importance and complexity of the role of chemical kinetics in combustion examples. The roles of chemical kinetics, together with molecular transport, aerodynamics, heat and mass transfer are discussed for the flame structure and dynamics of the laminar, turbulent, premixed and non-premixed flames. Through the course study, students are expected to more deeply understand the fundamentals of flames and gas combustion, including the reaction mechanisms and physical insights in the processes of flame propagation, ignition, stabilization and extinction, and pollutant formation. The course is divided into 11 chapters.

The first chapter is a general introduction of the course and reviews equilibrium thermodynamics; Chapter 2 reviews chemical kinetics and introduce the chemical mechanism and its development; Chapter 3 goes over the transport phenomena. Chapter 4 presents the general governing equations for chemical-reacting flows and their application in some special cases. Chapter 5 starts to introduction of gaseous combustion system by examining the structure of diffusion flames, including the physical and mathematical description of the flame structure, laminar flame speed and its measurements of premixed flames, and discuss the principles of flame stabilization. In Chapter 6, we will introduce the microgravity combustion and its latest progress. Chapter 7 will introduce the premixed flame and the laminar flame speed. The aerodynamic response of convective and diffusive non-uniformities is to be learned in Chapter 8. Chapter 9 talks about the critical phenomena of ignition and extinction, with physical and mathematical description. Chapter 10 studies the flames in the turbulent flow. It discusses the turbulent effect on the flame structure, propagation and stabilization of premixed and non-premixed flames. The course ends with Chapter 11 of the NOx formation and control, an application example of chemical kinetics and gas combustion. the critical phenomena of ignition and extinction are analyzed, with physical and mathematical description.

Three experiments are arranged during the course study. One is the diffusion jet flames, and one is on the laminar flame speed measurement of the premixed flames with counterflow technique and the other is on extinction limit

measurement of the premixed flames. Students will conduct the experiments on the diffusion jet flames in normal and inverse configuration, studying the flame structure and flame height, measuring the flame temperature and lift-off distance in the turbulent combustion region. Also, students are to measure the laminar flame speed and extinction limits of methane/propane premixed flames in the counterflow configuration, using the PIV technique. Students are expected to understand more physical insights of diffusion and premixed flames through these hand-on experiments.

(5)【Course Title】Gas Turbine: Key Technologies and Application
燃气轮机关键技术和应用

【Course Code】80140232
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】25 Graduate Students
【Instructor】REN Jing 任静
【Course Description】

The course is aimed to provide the information of the key technologies regarding the stationary power generation gas turbine, and other turbine based systems aimed at zero-emission. The course will started with a short introduction to the history of the gas turbine and the clean energy system. The main part of the course includes the key technologies of turbine, combustor, compressor, high temperature materials and the manufacture. The turbine system economics and operation is provided as the end part of the course to build up an overview concept of the gas turbine for the students. During the course，the students is asked to develop their own ideas on the key technologies of the gas turbine based on the innovation methodologies (Reverse engineering/SCAMPER/Six Hats and so on). As a main part of the course, the selected idea will be analyzed and tested by the students in group.

The general outline of the course is as following:

1. Introduction (history and features of the gas turbine)
2. Clean Energy System
   - 2.1 Simple and Combined Cycle
   - 2.2 Integrated Coal Gasification Combined Cycle (IGCC)
   - 2.3 Zero-emission Power (Oxyfuel, Hydrogen)
3. Key Technology of Turbine Cooling
   - 3.1 Basic Concept of Turbine
   - 3.2 Cooling Technology
   - 3.4 Coupled Aerothermal Optim. of Turbine
4. Cooling idea: generation, evaluation and realization
   - 4.1 Creative Methodology and Tools
   - 4.2 Design of Cooling Unit
   - 4.3 Analysis and Evaluation of the generated Cooling Unit

5. Key Technology of Combustor
    5.1 Type and Feature of the Conventional Combustor
    5.2 Pre-mixed Combustion/Multi-swirl Combustion
6. Axial-Flow Compressor
7. High Temperature Materials and Manufacture
    5.1 Super Alloy Development and Performance
    5.2 Protective Coating-Bond Coat and Top Coat
    5.3 Manufacture of the High-temperature components
8. Turbine System Economics and Operation (RAM)

(6)【Course Title】Methods in Combustion Research
燃烧研究前沿及方法

【Course Code】80140253
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】25 Graduate Students
【Instructor】You Xiaoqing 游小清
【Course Description】

This course introduces the frontier and methods in combustion research covering a variety of areas including reaction kinetics, laminar flames, laser diagnostics, turbulent flames, turbulent combustion modeling, droplets, jets, bubbles and phase transition, microgravity combustion and applications, detonation theory and structure, atmospheric chemistry and pollution, gas turbine combustion, IC engine combustion, and complex flame dynamics with particles, plasma and electrics.

1. Overview and reaction kinetics: Overview of combustion phenomena and challenges in experimental, computational and analytical research. Basic concepts of reaction kinetics, kinetic experiments and modeling, low temperature combustion and soot formation.
2. Laminar premixed flames: Phenomenological and asymptotic derivations, laminar flame speeds, asymptotic and chemical structures, response subjected to non-adiabaticity and aerodynamic stretching.
3. Laser diagnostics: Overview of some advanced laser diagnostic techniques, including tunable laser absorption spectroscopy and laser induced fluorescence; the fundamental theory, main experimental devices and implementation methods of these techniques; several working examples in the fields of fundamental research, industrial processes, aerospace and aeronautics, as well as health and medical applications.
4. Review and discussion
5. Turbulent flames: Characteristics of turbulence, flame-turbulence interactions, turbulent flame speed, scales in turbulent combustion, turbulent diffusion flames, and turbulent premixed flames, turbulent partially premixed flames, turbulent combustion regimes, combustion instabilities.

6. Modeling of turbulent combustion: An overview of the numerical approaches in turbulent combustion; RANS, LES, DNS simulations and examples of their applications to engineering and fundamental research problems, challenges in high-performance and parallel computing.
7. Drops, jets, bubbles and phase transition: Drop impact and collision, jet impact and collision, bubble entrapment, freezing and boiling drops, Leidenfrost dynamics, capillarity and wetting phenomena.
8. Review and discussion
9. Microgravity combustion and applications: Overview of the concept, experimental methods, and general phenomena observed in microgravity, typical combustion experiments and their objectives, theories of microgravity flames, data obtained from microgravity combustion experiments to develop sub-model in practical engine systems.
10. Detonation theory and structure: Chapman-Jouguet and Zeldovich-von Neumann-Doering theories, real structure, measurement and prediction of the detonation cell size, experimental techniques for visualization.
11. Atmospheric chemistry and pollution: Overview of the research status of atmospheric chemistry and pollution; the role of photochemistry in air pollution; the introduction to the theoretical study of photochemistry in the atmosphere.
12. Review and discussion
13. Gas-turbine combustion: Fundamentals of gas turbine combustor, with an emphasis on the challenges and issues and the research efforts to bridge the gap; gas turbine combustion systems; operability issues; emissions; challenges to low-carbon aviation.
14. Knocking combustion in internal combustion engines: Basic characteristics; fuel index of knock resistance; chemistry, pressure oscillation and heat transfer; visualization and analysis of combustion modes of engine knock; suppression methods for conventional knock and super-knock, etc.
15. Complex flame dynamics with particles, plasma and electrics: Overview of the coupling problems of classic flame dynamics with particles, plasma and electric fields in solid fuel combustion, catalytic combustion, flame synthesis, and combustion stabilization of gas turbine.
16. Review and discussion (1/10)

(7)【Course Title】Optimization of Energy Systems
能源系统最优化方法
【Course Code】80140262
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】30 Graduate Students
【Instructor】LIU Pei 刘培
【Course Description】

Energy systems appear in every single stage of energy conversion, and their performances and efficiency decide the overall energy utilization efficiency of a society. There exist many optimization issues in planning, design, and operation of energy systems. Solving these problems would help to increase the overall energy utilization efficiency, thus reduce energy consumption, air pollution and greenhouse gas emissions. An energy system usually comprises many sub-systems or sub-processes, and optimization of energy systems is mainly about how to integrate these sub-systems or sub-processes, so that they can work together with each other with enhanced overall efficiency. These sub-systems or sub-processes are usually nonlinear and difficult to model or optimize. In this course, we will cover state-of-the-art optimization methods, and illustrate how to apply these methods in real life problems via case studies.

(8)【Course Title】Combustion Chemistry
燃烧化学
【Course Code】80140333
【Credits】3
【Credit Hours】48
【Semester】Fall
【Capacity】25 Graduate Students
【Instructor】Yangbin 杨斌
【Course Description】
This course is to provide students with the understanding of the fundamental and application of combustion chemistry with topics ranging from a review of thermodynamics, thermochemical properties, basic quantum and statistical mechanics, reaction mechanisms and modeling, transition state theory, combustion kinetic model development and validation, fundamental combustion experiments, to surrogate fuels and kinetic mechanism for practical fuels. The Course focuses on the development, validation and analysis of the combustion kinetic models, which will help students advance the understanding of combustion at molecular level and learn the frontier of the combustion kinetic research.

1. Introduction (2)
2. Basic concepts in quantum chemistry and statistical mechanics (6)
    2.1 Valence bond theory and molecular orbital theory
    2.2 Chemical bonds in organic molecules
    2.3 Group additivity and bond energy
    2.4 Statistical mechanics description of thermochemical properties
3. Chemical kinetics and reaction rate rules (8)
    3.1 Chemical reaction rate (reaction type, the law of mass action, chain reaction, the Arrhenius law)
    3.2 Chemical reaction mechanism (explosion limit of hydrogen, NTC behavior)
    3.3 Collision theory
    3.4 Transition state theory

3.5 Unimolecular reaction and RRKM theory

4. Combustion kinetic model development (8)

4.1 Reaction network (low temperature, high temperature)

4.2 Reaction rate determination

4.3 Thermal database and transport database

Mid-term exam

5. Combustion kinetic model validation – homogeneous systems (6)

5.1 Jet-stirred reactor

5.2 Flow reactor

5.3 Shock tube/ Rapid compression machine

6. Combustion kinetic model validation – non-homogeneous systems (8)

5.4 Premixed flame

5.5 Coflow / counterflow nonpremixed flame

5.6 Combustion bomb

5.7 Experiments for elementary chemical steps

7. Combustion kinetic mechanisms for practical fuels (10)

7.1 Surrogate fuels

7.2 C0-C4 core mechanism

7.3 Kinetic mechanism for surrogate fuels

7.4 Kinetic mechanism for biofuels

7.5 Kinetic model for pollutant formation

(9)【Course Title】Combustion Physics II

燃烧物理 II

【Course Code】80140352

【Credits】2

【Credit Hours】32

【Semester】Fall

【Capacity】25 Graduate Students

【Instructor】Chung K. Law

【Course Description】

Combustion Physics II is concentrated in the theoretical modeling and analysis of different combustion phenomena: i.e., the flammability, extinction and stabilization of flames; aerodynamics of flames involving stretch and stabilities; and flames in different fluid environments including turbulent flows, boundary layer flows, two-phase flows and supersonic flows.

1. Introduction

1.1 Introduction of different combustion phenomena

2.2 Review of Combustion Physics I

2.3 Course schedule

2. Limit phenomena

2.1 Flammability and explosion limit

2.2 Extinction

2.3 Flame stabilization

3. Aerodynamics of laminar flames

3.1 Flame stretch: stretch rate, phenomenology and analyses

3.2 Flame instability: cellular instability and pulsating instability

4. Combustion in turbulent flows

4.1 Introduction of turbulence

4.2 Diagram of turbulent flame

4.3 Turbulent flame speed

4.4 Simulation of turbulent flame

5. Combustion in boundary layer flows

5.1 Assumptions and governing equations

5.2 Blasius flow

5.3 Ignition and stabilization

5.4 Jet flow: height, stabilization and blow off

6. Combustion in two-phase flows

6.1 Droplet combustion

6.2 Fuel vapor accumulation

6.3 Droplet collision

6.4 Spray combustion

6.5 Solid particle combustion and material synthesis

7. Combustion in supersonic flows

7.1 Supersonic flows and sound wave

7.2 Rankine-Hugoniot relation and Chapman Jouguet detonation

7.3 ZND structure of detonation waves

7.4 Detonation instability and initiation

（10）【Course Title】Physics of Gases and Non-equilibrium Phenonena
气体物理及非平衡现象

【Course Code】80140363

【Credits】3

【Credit Hours】48

【Semester】Fall

【Capacity】25 Undergraduate Students

【Instructor】Xu HaiTao, 徐海涛

【Course Description】

This course covers the physical foundation and mathematical treatment that lead to continuum descriptions of flows of microscopically discrete particles, including both molecules and inelastic hard spheres. Materials taught include introductory kinetic theory, molecular velocity distribution at equilibrium (Maxwellian distribution), molecular collisions and the mean free path,

molecular transport, non-equilibrium kinetic theory, the Boltzmann equation, binary collisions and collision integrals, the Chapman-Enskog solution of the Boltzmann equation, successive approximations, Euler Equation, Navier-Stokes equation, transport coefficients.

Chapter 1: Introduction of the course

1.1 Objectives, contents, evaluation, etc.

1.2 Review of mathematical tools

Chapter 2: Introductory kinetic theory

2.1 Distribution of molecular velocity function

molecular model, velocities, the distribution of molecular velocities, mean values

2.2 Flow of molecular properties

2.3 Pressure, temperature and internal energy

Chapter 3: Boltzmann equation

3.1 Derivation of Boltzmann equation

3.2 Molecular encounters and dynamics of binary collision

3.3 Equilibrium solution of Boltzmann equation and Maxwellian velocity distribution

Chapter 4: Introduction of molecular transport

4.1 Mean free path, collision frequency and persistence of velocity

4.3 Elementary theories of the transport phenomena

Chapter 5: The non-uniform state of a simple gas

5.1 General method of solution of Boltzmann equation

5.2 The first approximation, Euler equation

5.3 The second approximation, Navier-Stokes equation

Chapter 6: Transport phenomena

6.1 Transport coefficients: shear and bulk viscosity

6.2 Transport coefficient: thermal conductivity

6.3 Transport coefficients: comparison of theory with experiment

Chapter 7: Gas mixture (6)

7.1 Gas mixture at equilibrium (1)

7.2 The non-uniform state of a gas mixture (2)

7.3 Transport coefficients of a gas mixture (3)

（11）【Course Title】Physics of Gases and Non-equilibrium Phenonena

实验流体物理

【Course Code】80140373

【Credits】3

【Credit Hours】48
【Semester】Fall
【Capacity】25 Undergraduate Students
【Instructor】Sun Chao, 孙超
【Course Description】

Advanced experimental techniques for flow measurements are introduced based on the "measurement quantities and measurement processes" in physics of fluids. These techniques to be discussed in the course include digital image analysis, high-speed imaging, particle image velocimetry, Laser-Doppler anemometry, hot-wire anemometry, particle tracking and micro/nano-PIV. In the lectures, principles and specific advantages and limitations of the techniques will be discussed. This knowledge will be taught in lectures and deepened with research articles and homework questions. Following the lectures, hands-on experiments will be organized. In groups of two students, a specific measurement problem will be solved with one of the techniques presented in the course. The participants design the experiment, write a concise report and prepare a presentation on their work. Grades will be given on the written report (30%), the presentation (40%) and the handed in homework (30%).

The general outline of the course is as follows:

1. Introduction of the course
   1.1. Objectives
   1.2. Content
   1.3. Examples
   1.4. Grades
2. Digital imaging analysis and high-speed imaging
   2.1. Capillarity phenomena
   2.2. Digital imaging analysis
   2.3. High-speed imaging
3. Measurements of complex flows
   3.1. Thermal Anemometry
   3.2. Laser Doppler Velocimetry
   3.3. Particle Image Velocimetry
4. Journal club I
   4.1. Presentations from students on research articles
5. High-speed Particle Tracking Velocimetry
   5.1. Motion of particles, droplets and bubbles in complex flows
   5.2. Distribution of particles, droplets and bubbles in flows
   5.3. Velocity and acceleration measurements
6. Measurements of Microfluidics
   6.1. Special aspects of microfluidics

6.2. Measurement techniques (microPIV and others)

7. Measurements of convective heat transfer
   7.1. Global heat transfer
   7.2. Local heat transfer
8. Journal club II and project design
   8.1. Project design
9. Project
   9.1. Experiment and data analysis: experiment 1, experiment 2
   9.2. Presentation
   9.3. Report

(12) 【Course Title】Foundations and Applications of Quantum Chemistry
量子化学基础与应用

【Course Code】80140402
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】25 Undergraduate Students
【Instructor】Xu Xuefei, 许雪飞
【Course Description】

The main content of this course is the introduction to foundations of quantum chemistry. Considering the current knowledge structure of graduate students from thermal engineering, who will mostly be the potential audience, the course consists of three parts, quantum mechanics, the basis of the structure of matter, and applications. In the part of quantum mechanics, the course starts from the time-independent schrödinger equation, and introduce the basic concepts and theorems of quantum theory, as well as the variational method and perturbation theory, which both play important roles in the theoretical and quantum chemical study; in the part of the structure of matter, the course focuses on the atomic and molecular structures and the corresponding theorems, and a brief review of molecular symmetry, basic group theory and its application to chemistry. The general outline of the course is as following:

1. Introduction
   1.1 Overview of quantum chemistry
   1.2 Basics of quantum theory
2. Theorems of quantum mechanics
   2.1 The superposition of states
   2.2 Postulates of quantum mechanics
3. The variation method
   3.1 Variation theorem
   3.2 Variation treatment of the helium atom
4. Perturbation theory

4.1 Perturbation theory
4.2 Perturbation treatment of the helium atom
5. Discussion I
What's your understanding to quantum world?
6. Atomic structure
6.1 The structure and spectra of hydrogenic atoms
6.2 The structures and spectra of many-electron atoms
7. Molecular structure
7.1 Born-Oppenheimer approximation
7.2 Valence-bond theory
7.3 Molecular orbital theory
7.4 Electronic structure of diatomic molecules
8. Molecular symmetry and group theory
8.1 The symmetry elements of objects
8.2 The symmetry classification of molecules
8.3 Basics of group theory
8.4 Application of group theory to chemistry
9. Applications
9.1 Introduction to general software packages
9.2 Predicting chemical properties
9.3 Modeling chemistry in solution
9.4 Studying reaction mechanisms
9.5 Predicting spectra
9.6 Calculating rate constant of reaction
10. Discussion II
What's quantum chemistry good for?

(13)【Course Title】Numerical Methods in Fluid Dynamics and Heat Transfer (in English)

数值传热学（英）

【Course Code】30140362
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】30 Undergraduate Students
【Instructor】David M. CHRISTOPHER, 柯道友
【Course Description】

This course teaches the fundamentals of the finite difference method for modeling fluid dynamics and heat transfer problems. The course introduces steady-state and transient methods, the SIMPLE method, upwind versus central differencing, turbulence modeling, the effects of mesh quality and convergence characteristics. The course also teaches how to use Fluent to analyze fluid dynamics and heat transfer problems, including many of the special models in Fluent for modeling radiation, flows in porous media,

periodic flows and the User Defined Functions. The course includes numerous homework assignments and a final project related to their research work so that the students are very experienced in the use of numerical methods.

（14）【Course Title】Technical English Paper Writing
专业英语阅读
【Course Code】30140012
【Credits】2
【Credit Hours】32
【Semester】Fall
【Capacity】30 Undergraduate Students
【Instructor】David M. CHRISTOPHER, 柯道友
【Course Description】
This course focuses on the specialized vocabulary and grammar structures for writing technical English. The instructor gives many typical writing examples of proper grammar and word choice for technical English writing (and for business letters). The students will read many technical papers that are mostly related to thermal engineering, including ASME news articles and research papers. For some of the assignments, students from other departments can select research papers in their fields. The course will also include many technical English writing assignments. The course project is to write a short technical research paper related to their current research or their senior thesis. The course is very technical, so it should only be taken by science or engineering students.