# 

# COURSE CATALOG

# 2019-2020 Spring Semester

# Yanqihu Campus

# International College of UCAS

**General Introduction**

1. **Course Selection System-for Professional Courses Only**

This course selection system is for students registering professional courses online. From this semester all the courses will be opened for all students including Chinese students and International students. Because the capacity of every course is limited and first come first select, this system will be opened during Jan, 1st –Jan. 15th, 2020 and the students from International College can register first. Please use the google chrome or 360 browsers. Do not choose two courses schedule overlap.

**Website: http://ic-course.ucas.ac.cn/**

**Username: Your email address**

**Original password: 123456**

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| **Date** | **Process** |
| Jan. 1-Jan. 15 | Register professional courses in Course Selection System |
| Feb. 24 | Courses start |
| Feb. 24-Mar.6 | Sign up in the classes for confirmation the courses |
| Jun. 12 | Language classes end |
| Jun. 16 | All the professional courses end |

**Vocations:** Tomb-sweeping Day lasts from Apr.4th-Apr.6th; Labor Day lasts from May.1st-May. 5th.

1. **General Degree Requirements for Doctors**

The requirement of UCAS for Doctor Degree is to get at least 9 credits before graduation. 4 credits should be from Professional Degree Courses. But students from institutes need to check out the requirements of your own institutes. Each institute has different requirement of credits. Please contact the Educational Administration of your own institutes first.

1. **General Degree Requirements for Masters**

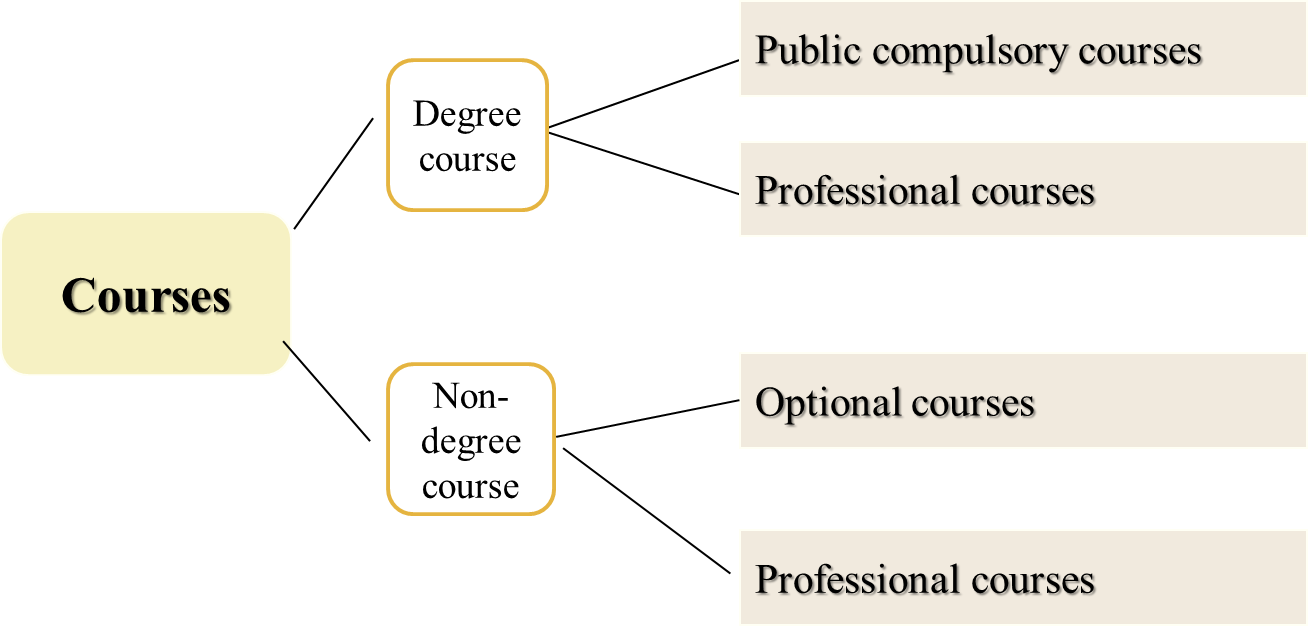
The requirement of UCAS for Masters is to get at least 30 credits before graduation. At least 13 credits should be from Professional Degree Courses. Every master student needs to take at least 2 credits from optional courses.

1. **General Degree Requirements for MD-PhD Students**

The requirement of UCAS for MD-PhD students is to get at least 38 credits before graduation. 12 credits are from the Public Compulsory courses. At least 16 credits should be from Professional Degree Courses. Every student needs to take at least 2 credits from optional courses.

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| **Types** | **Public compulsory courses** | **Optional courses** | **Professional degree courses** | **In total** |
| **Masters** | **6 credits** | **≥2 credits** | **≥13 credits** | **≥30 credits** |
| **PhD** | **6 credits** | **None** | **≥4 credits and ≥2 courses** | **≥9 credits** |
| **MD-PhD** | **12 credits** | **≥2 credits** | **≥16 credits** | **≥38 credits** |

1. **Courses Type**

Courses are classified as degree courses and non-degree courses. 

**5.1 Public compulsory courses (6 credits in total)—Degree Courses**

(1) Elementary Chinese-Reading and Writing (2 credits);

(2) Elementary Chinese-Listening and Speaking (2 credits);

(3) China Panorama (2 credits).

These three Public compulsory courses are Degree Courses for all international students. However, we have a rule about **Course Waiver**. Students who can meet one of the conditions can apply for course waiver and will get 6 credits directly.

A. Providing a certificate of HSK Level 3;

B. Got a bachelor’s degree or master’s degree which are taught in Chinese.

Students who apply for the course waiver need to contact Ms. Season ([**dingdanni@ucas.ac.cn**](mailto:dingdanni@ucas.ac.cn)**)** before the end of September.

**5.2 Professional courses—Degree Courses and Non-degree Courses**

Professional courses this year in Yanqihu campus cover several academic areas. Most Professional courses are once a week and each time lasts 4 class hours. If one professional course has several parts, students who select this course need to complete all parts of this course, otherwise s/he may fail the course.

The professional courses can be classified as one of two types: Degree Courses and Non-degree Courses. This final decision of course classification for each student is left to the supervisor, as s/he is in the best position to assess the courses for the graduate programs. If students find the professional courses are totally not related to his/her major and will not help the research for PhD, then these courses can be seen as Non-degree Courses (Optional Courses). If the professional courses will help the research for PhD, then they should be Degree Courses (Compulsory Courses). This classification of one course will be shown on the course selection form and the final score sheet. All the students have two weeks to attend the professional classes and choose them.

**5.3 Optional courses—Non-degree Courses**

All the optional courses are non-degree courses.

1. **Rules about courses results**

Students should drop out of the university under one of the following circumstances:

1、Master candidates who fail two degree courses within one semester and still fail one after relearning the courses, or fail three degree courses during the school years.

2、PhD candidates who fail one degree course and still fail after relearning the course, or fail two courses during their school years.

The Language courses and China Panorama are all Degree courses.

1. **Transcript**

**DO NOT** apply it from the International College.

There are two ways to get your transcript before graduation.

***Method 1: From Your Institute.***

Please check your transcript after the second year of your enrollment from your own institute, usually after the next November. **Do not ask it before that time!**

Ask your institute’s teacher print it out and stamp by your institute’s Academic Department.

***Method 2: From the Academic Affairs Department of UCAS(教务部).***

Please ask for it just before your graduation. Only one free copy.

Fill a form by yourself and stamped from your institute. Go to the Academic Affair Office and ask the teacher to print the transcript for you. Please make sure the working time and office address.

Academic Affair Office Working time（教务部）

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| **Campus** | **Time** | **具体地址Address** | **Tel** | **Type** |
| Yanqihu | Monday to Friday  13:30-16:00 p.m. | 雁栖湖行政办公楼217房间  Office Building Room 217 | 69671069 | Free |
| Zhongguancun | Fridays 8:30-11:00 a.m.\13:30-17:00 | 中关村校区教学楼东小楼204  Teaching Building East Building Room 204 | 82640466 | Free |
| Yuquan  Road | Wednesdays  8:30-11:00 a.m. | 玉泉路校区办公楼137房间  Office Building Room 137 | 88256199 | Free |
| Yanqihu | Thursdays  13:30-16:00 p.m. | 雁栖湖行政办公楼217房间  Office Building Room 217 | 69671069 | Charged |
| Yuquan  Road | Wednesdays  8:30-11:00 a.m. | 玉泉路校区办公楼137房间  Office Building Room 137 | 88256199 | Charged |

Every recent graduate student can get one transcript free. More than one copies are charged.

1. **Contact Information**

Education Coordinator for Professional Courses:

* Phone: 010-82680563, Ms. Sophie
* E-mail: [hutian@ucas.ac.cn](mailto:hutian@ucas.ac.cn)

Education Coordinator for Language Courses:

* Phone: 010-82680986, Ms. Season
* E-mail: [dingdanni@ucas.ac.cn](mailto:dingdanni@ucas.ac.cn)

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| **Code** | **Name** | **Type** | **Hours/Credits** | **Date&Time** | **Classroom**  **(Capacity)** | **Professors** | **First Class Date&Times** |
| 0713I0D01001H | Plant Physiology and Ecology | Professional courses | 60/4.0 | Thur.(5-8) | Teaching2-123(58) | Qu Laiye | Feb.27, 15 times |
| 0710I0D01006H | Nano-biology | Professional courses | 45/3.0 | Wed. (1-4) | Teaching2-427(100) | CHEN Deliang et al. | Feb.26, 11 times |
| 0710I0D01008H | Molecular Entomology and Plant Pathology | Professional courses | 60/4.0 | Tue.(5-8) | Teaching2-325(58) | LI Xiangdong et al. | Feb.25, 15 times |
| 0710I0D01009H | Biochemistry | Professional courses | 52/3.5 | Tue.(1-4) | Teaching2-418(58) | ZHONG Liangwei et al. | Feb.25, 13 times |
| 0710I0D01013H | Conservation Biology | Professional courses | 40/2.5 | Tue.(5-8) | Teaching2-327(100) | JIANG Zhigang | Mar.24, 10 times |
| 0710I0D01007H | Vector and Human Pathogen | Professional courses | 60/4.0 | Thur.(1-4) | Teaching2-319(58) | ZHENG Aihua et al. | Feb.27, 15 times |
| 0710I0D01010H | Introduction to Epigenetics and RNA Silencing | Professional courses | 60/4.0 | Thur.(5-8) | Teaching2-234(46) | ZHANG Xiaoming et al. | Feb.27, 15 times |
| 0710I0D01011H | Nanobiological Sensing and Detection | Professional courses | 60/4.0 | Tue.(5-8) | Teaching2-318(58) | LI Lele | Feb.25, 15 times |
| 0703I0D01002H | Nanotechnology for Solar Energy Utilization | Professional courses | 60/4.0 | Thur.(5-8) | Teaching2-227(100) | HE Tao | Feb.27, 15 times |
| 0703I0D01003H | Nano Electronic Materials | Professional courses | 60/4.0 | Wed.(3-6) | Teaching2-329(58) | XIE Liming | Feb.26, 15 times |
| 0709I0D01001H | Plate Tectonics and Evolution of Tibetan Plateau | Professional courses | 60/4.0 | Thur.(5-8) | Teaching2-338(46) | DING Lin et al. | Feb.27, 15 times |
| 0705I0D01001H | Physical Geography | Professional courses | 60/4.0 | Tue.(5-8) | Teaching2-227(100) | FANG Xiaomin et al. | Feb.25, 15 times |
| 0713I0D01002H | Global Change Ecology | Professional courses | 60/4.0 | Wed.(5-8) | Teaching2-206(156) | WANG Tao et al. | Feb.26, 15 times |
| 0706I0D01001H | Climate Change | Professional courses | 60/4.0 | Mon.(1-4) | Teaching2-429(100) | MA Yaoming et al. | Feb.24, 15 times |
| 0817I0D01001H | Chemical Reaction Engineering | Professional courses | 60/4.0 | Tue.(1-4) | Teaching2-423(58) | LI Chunshan et al. | Feb.25, 15 times |
| 0817I0D01003H | Energy Chemistry and Chemical Engineering | Professional courses | 60/4.0 | Mon.(5-8) | Teaching2-338(46) | LI Songgeng et al. | Feb.24, 15 times |
| 0817I0D01002H | Green Chemical Engineering | Professional courses | 60/4.0 | Wed.(1-4) | Teaching2-225(58) | ZHANG Guangjin | Feb.26, 15 times |
| 0817I0D01005H | Fluidization and Multiphase Flow | Professional courses | 60/4.0 | Tue.(5-8) | Teaching2-319(58) | WANG Wei | Feb.25, 15 times |
| 0714I0D01002H | Applied Statistics | Professional courses | 40/2.5 | Thur.(5-8) | Teaching2-421(58) | WANG Qian | Feb.27, 10 times |
| 050200DGX001H-1 | Academic Communication for International Conferences | Optional courses | 48/2.0 | Tue.(1-4) | Teaching2-218(58) | YU Hua | Feb.25, 12 times |
| 050200DGX001H-2 | Academic Communication for International Conferences | Optional courses | 48/2.0 | Wed.(1-4) | Teaching2-419(58) | LIU Yunlong | Feb.26, 12 times |

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| **Class time** | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 08:30-  09:20 | 09:20-  10:10 | 10:30-  11:20 | 11:20-  12:10 | 13:30-  14:20 | 14:20-  15:10 | 15:30-  16:20 | 16:20-  17:10 | 19:00-  19:50 | 19:50-  20:40 | 20:50-  21:40 |

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| **Chinese Courses for New Students** | | | | | |
| **Name** | **Type** | **Hours/Credits** | **Time** | **Classroom** | **Teachers** |
| Elementary Chinese-Reading and Writing | Public compulsory courses | 128/2.0 | Mon.(1-2) | Teaching2-213 | WANG Lei |
| Wed.(3-4) | Teaching2-213 |
| Thur.( 1-2) | Teaching2-213 |
| Fri.(3-4) | Teaching2-213 |
| Elementary Chinese-Reading and Writing | Public compulsory courses | 128/2.0 | Mon.(3-4) | Teaching2-213 | HE Fei |
| Wed.(1-2) | Teaching2-213 |
| Thur.(3-4) | Teaching2-213 |
| Fri.(1-2) | Teaching2-213 |
| China Panorama | Public compulsory courses | 48/2.0 | Wed.(9-11) | Teaching1-225 | JIANG Hong’en |

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| **Class time** | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 08:30-  09:20 | 09:20-  10:10 | 10:30-  11:20 | 11:20-  12:10 | 13:30-  14:20 | 14:20-  15:10 | 15:30-  16:20 | 16:20-  17:10 | 19:00-  19:50 | 19:50-  20:40 | 20:50-  21:40 |





**Teaching 2**

**Course title:**

**Plant Physiology and Ecology**

**Instructor:**

*Associate Prof. Laiye Qu*

**Course type:***Lecture*

**Course Assessment:**

*None*

**Grading Policy:**

*Registration (10% of the final score)*

*one report (40% of the final score)*

*one quiz (50% of the final score)*

**Course Prerequisites:**

*None*

**Catalog Description:**

*This course will introduce the plant physiological mechanisms that underlie ecological observation under the changing environment. The course will mainly introduce some general knowledge of photosynthesis, plant water relations, mineral nutrients, growth and allocation, symbiosis associations, and plant-soil interaction. Some general research methods and some basic statistical analysis and statistical plotting also will be introduced.*

**Schedule of the course**

|  |  |  |
| --- | --- | --- |
| No. | Objectives | Remarks |
| 1. | General Introduction |  |
| 2. | Plant adaption |  |
| 3. | Photosynthesis |  |
| 4. | Respiration |  |
| 5. | Plant water relations |  |
| 6. | Mineral nutrients |  |
| 7. | Growth and allocation | Report |
| 8. | Symbiotic associations |  |
| 9. | Biotic interactions |  |
| 10. | Decomposition |  |
| 11. | Biodiversity |  |
| 12. | Succession |  |
| 13. | Rehabilitation |  |
| 14. | Plant-soil feedback |  |
| 15. | Discussion and examination | Presentation |

**Course title**

**Nano-biology**

**Instructor(s)-in-charge:**

*Assoc. Prof. Chen Deliang & Assoc. Prof. Zhang Zhuqing*

**Course type:**

*Lecture*

**Course Assessment:**

*Each student is expected to give an oral presentation on a topic related to his/her own interest and to Nanobiology*

**Grading Policy:**

*30% assessment, 70% final exam (open).*

**Course Prerequisites:**

*No.*

**Catalog Description:**

*Nanobiology is to understand the Biological Science in the nanometer scale. Targeting at graduate students in Biology, Chemistry, Physics and Engineering with interest in Biological Science, this course not only introduces the basic concepts, principles and techniques of Nanobiology, but also* *presents many of the lessons that may be learned from nature and how they are being applied to nanotechnology. Participants will be guided to discuss latest discoveries and hot topics, such as manipulating single molecules and protein design in related interdisciplinary fields.* **Schedule of the course**

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| |  |  |  | | --- | --- | --- | | section | content |  | | 1 | Introduction to Nanobiology | History, Progress and Objectives of Nanobiogy. | | 2 | Structural Mechanism in Bio-nanomaterials | Building Block of Bio-nanomaterials; Protein Nanostructures;  DNA Nanostructures;  Lipid Nanostructures. | | 3 | Functional Mechanism in Bio-nanomaterials | Energy Conversion;  Chemical Synthesis;  Transport and Transduction. | | 4 | Progress and hot Topics in Nanobiology | Design of Bio-nanomaterials;  Self-assembly and Recognition;  Biomolecule Motors;  DNA/Protein Computing;  Biosensors;  Nanomedicines. | | 5 | Techniques and Approaches in Nanobiology | Single Molecule Imaging: STED, STORM, PALM;  Single Molecule Manipulating: AFM, STM, OT, MT. | | total |  |  | |

**Contents of the course**

*See the contents in the course schedule*

**Textbook and any related course material**

*Bionanotechnology: lessons from nature; 1st edition*

*David S. Goodsell,*

*Wiley-Liss, Inc. 2004*

*References will be provided in class.*

**Course title**

**Molecular Entomology and Plant Pathology**

**Instructor(s)-in-charge:**

*Prof. LI Xiang-Dong; Prof. ZOU Zhen; Prof. LIU Jun*

**Course type:**

*Lecture*

**Course Assessment:**

*Quiz, exams, and home work*

**Grading Policy:**

*Final scores will be determined by 33.3%(LI),33.4%(ZOU), and 33.3%(LIU).*

**Course Prerequisites:**

*Without*

**Catalog Description:**

*This course will cover the basis of modern agriculture biotechnology, molecular entomology and plant pathology. In the first part, we will explain the importance of insect science and its impact on agriculture, forest, and human health. We will also discuss several important aspects of molecular insect such as metabolism, endocrinology, immunity, locomotors system etc. The basic knowledge of insect physiology, molecular biology, and biochemistry, which were used to study entomology, will be provided during the class. The second part of the course will give students the general view of the history and development of plant pathology. Particularly, the concepts of plant innate immunity and plant epidemiology will be introduced and emphasized, including PAMPs triggered immunity, effector triggered immunity and basal defense of plants. In addition, plant pathogen isolation and identification and plant protection will be discussed in the course.*

**Schedule of the course**

|  |  |  |
| --- | --- | --- |
| section | content | Lecturer |
| 1 | Introduction to entomology | Zhen Zou |
| 2 | DNA synthesis, transcription, and translation | Zhen Zou |
| 3 | Insect transgenesis and comparative genomics | Zhen Zou |
| 4 | Molecular Systematics and Phylogeny | Zhen Zou |
| 5 | Circulatory system, Endocrinology and Reproduction /First Exam | Zhen Zou |
| 6 | Insect Nervous Systems | Xiangdong Li |
| 7 | Insect Visual Signaling | Xiangdong Li |
| 8 | Insect Chemical Communication | Xiangdong Li |
| 9 | Insect Mechanical Communication | Xiangdong Li |
| 10 | Insect Locomotor Systems /Second Exam | Xiangdong Li |
| 11 | Introduction to plant pathology | Jun Liu |
| 12 | Plant basal defense | Jun Liu |
| 13 | Plant innate immunity | Jun Liu |
| 14 | Plant epidemiology | Jun Liu |
| 15 | Disease management and plant protection/Third Exam | Jun Liu |
| Total |  | 60 |

**Textbook and any related course material:**

Marc J. Klowden (2007) Physiological Systems in Insects. 2nd Ed. Elsevier Inc. (One annotated version permitted to publish in PRC)

George N. Agrios (2005) Plant Pathology, Fifth Edition Acadmeic Press, London, UK.

Reg Chapman (1997) The Insects Structure and Function 4th Ed. University Press, Cambridge, UK.

Lawrence I. Gilbert (2012) Insect Biochemistry and Molecular Biology. Acadmeic Press, London, UK.

**Course title**

**Biochemistry**

**Instructor(s)-in-charge:**

*Prof. ZHONG Liangwei and Associate Professor ZHANG zhuqing*

**Course type:**

*Lectures* *and project works*

**Course Assessment:**

*A written final examination and an oral presentation of a project work.*

**Grading Policy:**

*An open written final examination (60%), an oral presentation of a project work (30%) and attendance (10%).*

**Course Prerequisites:**

*A knowledge on organic chemistry.*

**Catalog Description:**

*Upon completion of the course, the students should: (1) be familiar with the basic properties and functions of amino acids and proteins, as well as the principle for protein separation, purification, identification; (2) know how to analyze enzyme activity, enzyme kinetics and protein-protein interaction; (3) understand protein synthesis, targeting and modifications; (4) understand the association of abnormal glucose, lipid and amino acid metabolism with diseases; (5) be able to explain connections among carbohydrate metabolism, lipid metabolism and amino acid metabolism; (6) be able to evaluate biochemical literatures and give an oral presentation.*

**Content**

The course is divided into the following parts:

Introduction to Biochemistry (Professor ZHONG liangwei)

Section A – Amino acids and proteins (Professor ZHONG liangwei)

A1. Amino acids and proteins

A2. Structures and functions of proteins

A3. Purification of proteins

Section B – Enzymes (Professor ZHONG Liangwei)

B1. Properties of enzymes

B2. Factors affecting enzyme activity

B3. Enzyme kinetics and inhibition

Section C – Protein synthesis, targeting, modifications and folding (Professor ZHONG Liangwei and Associate Professor ZHANG zhuqing)

C1. Protein synthesis

C2. Protein targeting

C3. Protein modifications

C4. Protein folding and structure-based drug design (Associate Professor ZHANG zhuqing)

Section D – Carbohydrate metabolism (Professor ZHONG Liangwei)

D1. Basic properties of carbohydrates

D2. Metabolic pathways

D3. Digestion and absorption

D4. High glucose and oxidative stress

Section E – Lipid metabolism (Professor ZHONG Liangwei)

E1. Structure and roles of fatty acids

E2. Fatty acid breakdown and synthesis

E3. Cholesterol metabolism

E4. Lipoproteins

Section F – Nitrogen metabolism (Professor ZHONG Liangwei)

F1. Nitrogen fixation and assimilation

F2. Amino acid metabolism

F3. Urea cycle

**Teaching methods**

The teaching includes lectures and project works.

Project works encourage intensive reading of literatures, giving an oral presentation.

**Suggested Textbook, References, and Link**

* Lehninger, Principles of Biochemistry, fourth edition.
* Oxidative stress, inflammation and carcinogenesis are controlled through the pentose phosphate pathway by transaldolase, *Trends Mol Med* **17** (2011) 395-403.
* Regulation of cellular metabolism by protein lysine acetylation, *Science* **327** (2010) 1000-1004.
* Thioredoxin 1 Is Inactivated Due to Oxidation Induced by Peroxiredoxin under Oxidative Stress and Reactivated by the Glutaredoxin System, *J Biol Chem.* **288** (2013) 32241-32247.
* Entrez Medline: http://www.ncbi.nlm.nih.gov/pubmed/

**Course title**

**Conservation Biology**

**Instructor(s)-in-charge:**

*Prof. JIANG Zhigang and Associate Professor LIU Xuecong*

**Course type:**

*Lecture*

**Course Schedule:**

*4hrs/week by instructors. When there is time, a classroom discussion will be led by the teaching assistant.*

**Course Assessment:**

*Homework: 3 assignments*

**Grading Policy:**

*30% homework, 70% final.*

**Course Prerequisites:**

*University level with background in Biological Science, Agricultural Science, Forestry Science, Environmental Science, Management Science or Medical Science*

**Catalog Description:**

*Conservation Biology is a science of protecting biodiversity, preventing human introduced species extinctions and maintaining sustainable development of human society. As a new branch of science, Conservation Biology was established in mid-1990s in the United States of America, and have fully grown into a main stream science since its’ born. In this course, the professor will start with a brief review of human civilization, particularly, the concepts such as public goods, consumerism, consumer behavior in modern society, and will argue rethinking about* Tao Te Ching *and social norms. Then the professor will give an introduction about the history, scope and missions as well as theoretic frames and practice means of Conservation Biology. In the second class, the professor will talk about the principles, methods and characteristics of Conservation Biology, which now is transforming into a new science—Conservation Sciences. Basic research skill and tool in experimental design and data analyses in conservation will be given will a classroom training in using statistic package. Species diversity is the core of biodiversity. The professor will introduce the concept of species in evolution, the Tree of Life, elaborate the speciation and extinction of species and the last effort of reviving an extinct species—the de-extinction, plus the famous question in science: “how many species are there on the Earth?”. The professor will outline the mega biodiversity countries, biodiversity hot spots, global vs. China vegetation. China is one the countries with mega-biodiversity in the world. The geological environment in the country experienced major geophysical events like tectonic movement and the up-lifting of the Qinghai-Tibetan Plateau since the Late Tertiary. The professor will also introduce the diverse landscapes, the sharply contrasting climate types, different habitats and rich fauna and flora in the country. Primates are the flagship species in ecosystems, an introduction about the status, ecology and behavior, conservation of primates with the charismatic golden snub-nosed monkey as an example. The professor will talk about the threatened wild species and degraded natural ecosystems in the country due to intensified human activities, land-cover change, environmental pollution, growing of human population plus the influence of global change. The professor will talk about the legend of giant panda as an example of flagship species and the down-listing of giant panda in 2016, the professor will introduce the IUCN Red List Criteria for Endangered Species and China’s Red List for Vertebrate, with exercise in assessing species using the IUCN Red List Criteria for Endangered Species. The professor will elaborate the biodiversity relevant international treaties like Convention on Biological-Diversity (CBD), Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES), which provide the international environment for conservation and the country ‘s endeavor in implementation its commitments. Besides to conduct basic research in classifying, inventorying and monitoring biodiversity, the scientists in country also carried out conservation researches to back up the commitments of the government to implementation of CBD and CITES, such as rescuing endangered species, reforesting the mountains and deserts, as well as protecting habitat of wild species and maintaining ecosystem functioning and services. All these be covered in the course. Therefore, while reviewing the current development of Conservation Biology in the world, the professor will give case studies of China’s endemic species; represent biomes and conservation practice to enrich the contents of course. The professor will explain why should we carry out ex situ conservation and how to carry out it, with examples of ex situ conservation from Saudi Arabia and China. The professor will introduce the translocation of endangered species and reintroduction of local extinct species. With practice in computer simulation, the students will understand the genetic problems in small populations. In situ and ex situ conservation are major approaches in preserving biodiversity. The professor will introduce the protected areas (PAs) such as, natural reserves, wildlife refuge, national parks, World Natural Heritage Sites, as well as the “Green for Grain”, “Green for Grass” projects in China as examples of* in situ *conservation, and will review the development and analyze the achievements and shortfalls in management of PAs.*

**Schedule of the course**

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| |  |  |  | | --- | --- | --- | | Lecture | Contents | Hours | | 1 | History of Conservation | 4 | | 2 | Principles, Ideas and Methods in Conservation Science | 4 | | 3 | Introduction to Experimental Design and Data Analyses in Conservation | 4 | | 4 | Speciation, Extinction and De-Extinction | 4 | | 5 | Biodiversity in China | 4 | | 6 | Status, Behavior and Conservation of Primates | 4 | | 7 | Endangered Species Criteria and IUCN Red lists | 4 | | 8 | Protected Areas | 4 | | 9 | Ex-situ Conservation | 4 | | 10 | Examination | 4 | | Total |  | 40 | |

**Contents of the course**

**Lecture 1:** History of Conservation

1. Human civilization
2. The biodiversity crisis
3. The nascent of Conservation Biology
4. Public goods, consumerism and consumer behavior
5. Environment problems we confronted
6. Rethink about *Tao Te Ching* and Social Norms
7. The nascent of Conservation Biology

**Lecture 2** Principles, Ideas and Methods in Conservation Science

1. Mega biodiversity countries
2. Biodiversity hot spots
3. Physical geography of China
4. Case study: Video BBC Wild China
5. Vegetation: global vs. China
6. Origin centers of crops in the world
7. Crops, fruits and garden plants native to the far east

**Lecture 3** Introduction to Experimental Design and Data Analyses in Conservation

1. Experimental design in Conservation
2. Descriptive statistics
3. Hypothesis testing
4. Introduction to SPSS
5. A classroom practice

**Lecture 4** Speciation, Extinction and De-Extinction

1. Evolution of species concept
2. The Tree of Life
3. “How many species are there on the Earth?”
4. Speciation
5. Extinction of species
6. The De-Extinction

**Lecture 5** Biodiversity in China

1. Mega biodiversity countries
2. Biodiversity hot spots
3. Physical geography of China
4. Video BBC Wild China
5. Vegetation: global vs. China
6. Origin centers of crops in the world
7. Crops, fruits and garden plants native to the far east

**Lecture 6:** Criteria of endangered species and IUCN Red lists

1. Criteria of endangered species
2. The Down-listing of giant panda in 2016
3. The legend of giant panda
4. IUCN Red List for Endangered Species
5. China’s Red List for Vertebrates

**Lecture 7:** Status, Behavior and Conservation of Primates

1. Primates of the world
2. Primate societies
3. Conservation status of primates in China
4. Ecology of endangered golden snub-nosed monkeys
5. Vocal behavior of golden snub-nosed monkeys

**Lecture 8:** Ex-situ Conservation

1. Why ex situ conservation?
2. How to carry out ex situ conservation?
3. Case study: Wildlife Conservation Center in Saudi Arabic
4. Genetic problems in small populations
5. Case study: Web PopGen® simulation
6. Reintroduction of Saiga in China
7. Behavioral problems in captive bred animals
8. A synthesis: Captive Breeding of Giant Panda
9. Ex situ conservation of plants: Germplasm resource repository and botanical gardens
10. Artificial propagation of *Drebremium*

**Lecture 9:** Protected Areas

1. The definition of Protected Areas (PAs) by IUCN
2. IUCN categories of PAs
3. The growth of PAs in the world and in China
4. The challenges in the PAs management
5. The conservation migratory species: the example of Mongolian gazelle
6. The Half-Earth Initiative--How much we can set aside?

**The final mark of the student will be 30% classroom performance (attendance and exercise) + 70% final exam. The final exam will be an open class exam.**

**Textbook and any related course material:**

Gaston, K. J. 1996. *Biodiversity: A Biology of Numbers and Differences*. Oxford: Blackwell Science.

Hannah L.2012. *Saving a Million Species: Extinction Risk from Climate Change*. Washington, DC: Island Press.

Jeon Yonung-jae. 2012. Journey to the Ecosystem of the DMZ and CCL. Seoul: Korea National Park Serves, Ministry of Environment.

Jiang, Z. 2016. The deterministic effect of the CITES and nominal impacts of social norms on global wildlife trade. RE: “Collective Action: Social norms as solutions” Science 354:42-43. http://science.sciencemag.org/content/354/6308/42.e-letters.

Jiang, Z. 2016. The responsibility and readiness of young conservation scientists. E-letter to P. Gluckman. The science–policy interface. Science 353: 969. <http://science.sciencemag.org/content/353/6303/969.e-letters>

Jiang Z. 2002. *Key Topics in Biodiversity and its Conservation*, an English training book for UNDP/UNEP/GEF Biodiversity Support Program for the Northwest and East Central Asia Region.

McCord E L. 2012. *The Value of Species.* New Haven: Yale University Press.

Novacek, M.J. 2001. *The Biodiversity Crisis.* New York: The New Press.

Primack, R. B. 2010. *Essentials of Conservation Biology*. 5th ed. Sinauer Associates, Inc. Sunderland, USA.

Stearns, BP and Stearns SN. 1999. *Watch, from the Edge of Extinction*. New Haven: Yale University Press.

Wilson, E. O. 2001. *The Diversity of Life*. London: Penguin Books. [Twice winner of Pulitzer Price]

*Video BBC Wild China*

**Expected level of proficiency from students entering the course:**

*Biology or applied biology sciences like Agricultural Science, Forestry Science， Environmental Science, Aquatic and Oceanic Sciences, Medical and Vet Science as well as in Science and Management Science: university level*

**Course title**

**Vector and human pathogen**

**Instructor(s)-in-charge:**

*Prof. Aihua Zheng*

*Prof. Xiangjiang Zhan*

*Prof. Zhen Zou*

**Course type:**

*Lecture*

**Course Assessment:**

*mini-tests in each section*

**Grading Policy:**

*mini-tests scores*

**Course Prerequisites:**

*Without*

**Catalog Description:**

*This course will introduce the principle of molecular entomology and microbiology. In the first part, we will introduce the importance of insect transmitted diseases and their impact on human health, economy and safety. In the second part, we will discuss several kinds of important human pathogens including the bacteria, plasmodium, and particularly virus. The basic knowledges of virus isolation, virus structure, virus life cycle will be provided in this course. In the third part, we will discuss several important aspects of molecular entomology such as metabolism, endocrinology, immunity, and their relations to the transmission of pathogens. During this course, the progress and application of some of the hottest technologies including CRISPR-Cas9 and deep sequencing will also be discussed.*

**Schedule of the course**

|  |  |  |
| --- | --- | --- |
| section | Content | Lecturer |
| 1 | Introduction to vector biology and human pathogens | Aihua Zheng |
| 2 | Genomes and genetics/virus life cycle | Aihua Zheng |
| 3 | Virus structure | Aihua Zheng |
| 4 | Virus receptor and entry | Aihua Zheng |
| 5 | Virus replication, transcription and assembly | Aihua Zheng |
| 6 | Infection basics and acute infection | Aihua Zheng |
| 7 | Immunology | Aihua Zheng |
| 8 | Basic of pathogenesis/HIV | Aihua Zheng |
| 9 | Vaccine | Aihua Zheng |
| 10 | Tick biology and tick-borne disease | Aihua Zheng |
| 11 | Deep sequencing and genome biology | Xiangjiang Zhan |
| 12 | Animal migration and epidemic | Xiangjiang Zhan |
| 13 | Insect vectors transmitting human and plant pathogens | Zhen Zou |
| 14 | Interactions between insect vectors and pathogens | Zhen Zou |
| 15 | Emerging virus/virus evolution | Aihua Zheng |

**Textbook and any related course material:**

David M. Knipe, Peter Howley (2013) Fields Virology，6th edition, Lippincott Williams & Wilkins.

Michael G. Rossmann, Venigalla B. Rao (2012), Viral Molecular Machines, Springer.

Marc J. Klowden (2007) Physiological Systems in Insects. 2nd Ed. Elsevier Inc. (One annotated version permitted to publish in PRC)

Reg Chapman (1997) The Insects Structure and Function 4th Ed. University Press, Cambridge, UK.

Lawrence I. Gilbert (2012) Insect Biochemistry and Molecular Biology. Acadmeic Press, London, UK.

**Course title**

**Introduction to Epigenetics and RNA silencing**

**Instructor(s)-in-charge:**

*Prof. Xiaoming Zhang 010-64807550 zhangxm@ioz.ac.cn*

*Prof. Xianhui Wang 010-64807220 wangxh@ioz.ac.cn*

*Prof. Weiqiang Qian (Peking University)010-62768230 wqqian@pku.edu.cn*

**Teaching assistant:**

*Dr. Qi Li 010-64807550 liqi@ioz.ac.cn*

**Course type:**

*Lecture*

**Course Assessment:**

*mini-tests in each section*

**Grading Policy:**

*mini-tests scores*

**Course Prerequisites:**

*Without*

**Catalog Description:**

*RNA Epigenetics and RNA silencing are two of the hottest topics in the past two decades. Epigenetics is the study of heritable changes in gene expression that do not change DNA sequence.RNA silencing is a general regulation mechanism in eukaryotes that regulates gene expression by 20-30 nt sRNAs in transcription or post-transcription levels. In this Epigenetics, we will introduce how DNA methylation, histone modification, chromatin remodeling, long non-coding RNAs and RNA modification regulate gene expression in eukaryotes. In the second part, we will study RNA silencing on sRNA generation, amplification, loading, action, turnover, and function. The most popular technologies used in Epigenetic studies and non-coding RNAs will also be discussed.*

*This course not only will provide students the basic concepts of RNA silencing and Epigenetics, but also will provide student the requisite methods in these two fields. At the same time, we will share the students a story in RNA silencing or Epigenetic fields in each class. These stories include but not limit to: Transgenic technology, Cross-kingdom RNA silencing, anti-viral function of RNA silencing, X-inactivation, Transgenerational epigenetic inheritance, Imprinting, disease, Honey bee epigenome, and flowing. After the course, the students should understand the biogenesis and function of small RNAs, lncRNAs, the difference between genetic and epigenetic regulation and how to study projects relate to Epigenetics and RNA silencing.*

**Schedule of the course**

|  |  |  |
| --- | --- | --- |
| section | Content | Hours |
| 1 | Introduction to Epigenetics and RNA silencing | *4* |
| 2 | Histone modification / X-inactivation | *4* |
| 3 | Histone variation / Epigenetics regulation in disease | *4* |
| 4 | Chromatin remodeling / Epigenetics in flowering | *4* |
| 5 | DNA methylation-establishment and maintenance / Imprinting | *4* |
| 6 | DNA demethylation / Molecular tools to study DNA methylation | *4* |
| 7 | Transgenerational epigenetic inheritance / Honey bee epigenome | *4* |
| 8 | sRNA processing / Genetic engineering | *4* |
| 9 | sRNA amplification and loading / RNA silencing function in plant immunity to virus | *4* |
| 10 | Target recognition and action of sRNAs / Popular tools to study RNAi | *4* |
| 11 | The modification and degradation of sRNAs / Animal virus and RNA silencing | *4* |
| 12 | The movement of RNA silencing / Cross-kingdom RNAi | *4* |
| 13 | The application of RNA silencing in research, human health and crop production | *4* |
| 14 | Long non-coding RNA, Circular RNA and RNA modifications | *4* |
| 15 | Bioinformatics tools to study RNA silencing and Epigenetic | *4* |
| Total |  | 60 |

**Textbook and any related course material:**

C. David Allis, Marie-Laure Caparros, Thomas Jenuwein, Danny Reinberg (2015) Epigenetics，2nd Ed, CSHL press.

Narendra Tuteja, Sarvajeet Singh Gill (2013) Plant Acclimation to Environmental Stress, Springer.

Kenneth Alan Howard (2013) RNA Interference from Biology to Therapeutics (Advances in Delivery Science and Technology), Springer.

Tamas Dalmay (2017), Plant Gene Silencing: Mechanisms and Applications, CABI press.

**Course title**

**Nanobiological Sensing and Detection**

**Instructor(s)-in-charge:**

*Prof. Lele Li*

**Course type:**

*Lecture*

**Course Assessment:**

*Homework: 7 assignments*

**Grading Policy:**

*Assignments 50%, Final 30%, Attendance 20%*

**Course Prerequisites:**

*College Chemistry, College Materials, English.*

**Catalog Description:**

*Biosensing and imaging using nanomaterials and nanotechnology has the potential to revolutionize scientific research and medical diagnostics. This course will focus on the principles, construction, and application of Nano-biosensing and imaging systems, and particularly the impact of nanotechnology on the development of biosensors. The course will be started with an introduction of the solid background on the nano-biological sensors, bioimaging, nanomaterials and nanotechnology, biorecognition units, biomarkers, and disease diagnostics. Then, examples of biosensing and imaging systems created from various nanomaterials are introduced, including fluorescent/luminescent nanoparticles, magnetic nanoparticles, carbon nanomaterials, gold nanoparticles, porous materials, and DNA nanostructures, with a distinct emphasis on the need to tailor nanosensor designs to specific biotargets. The topic of cancer-specific nano-biosensors will also be addressed and discussed to provide deep insight into the recent advances of using nano-biosensors for disease diagnostics and therapy.*

**Schedule of the course**

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| |  |  | | --- | --- | | No. | content | | 1 | Introduction of nano-biosensing and imaging technology | | 2 | Nanostructured materials used for construction of biosensing and imaging systems | | 3 | Surface functionalization of nanomaterials with biorecognition unit | | 4 | Principles of biosensing and imaging design for overcoming biological barriers | | 5 | Quantum dots-based fluorescent biosensing and imaging | | 6 | Lanthanide ions-doped nanomaterials for luminescent biosensing and imaging | | 7 | Gold nanomaterials-based biosensing and imaging | | 8 | Magnetic nanomaterials-based biosensing and imaging | | 9 | Carbon nanomaterials-based biosensing and imaging | | 10 | Mesoporous silica-based biosensing and imaging | | 11 | Metal-organic frameworks-based biosensing and imaging | | 12 | DNA nanotechnology for biosensing and imaging | | 13 | Fluorescent biosensors based on aggregation-induced emission | | 14 | Biosensing and imaging systems for theranostics | | 15 | Current trends and perspectives for Nano-Biosensors | |

**Textbook and any related course material:**

*No textbook, and electronic course reading materials will be provided one week before each class.*

**Course title**

**Nanotechnology for Solar Energy Utilization Applications**

**Instructor(s)-in-charge:**

*Prof. HE Tao*

**Course type:**

*Lecture*

**Course Assessment:**

*Four assignments: Exercise & Presentation*

**Grading Policy:**

*Typically 40% presentation, 40% exercise, 20% final*

**Course Prerequisites:**

*Materials physics, materials chemistry, solid state physics, semiconductor physics, physical chemistry, general chemistry*

**Catalog Description:**

*Because of concerns regarding energy security, environmental crisis, and the rising costs of fossil-fuel-based energy, there has been significant, resurgent interest in utilization of solar energy recently due to its clean nature and abundance of the source. Unfortunately, the utilization efficiency is still pretty low, which dramatically limits the wide use of solar energy. Nanotechnology may afford a solution to this. Thus, the major goal of this course is to provide the students general concepts and state-of-the-art developments in the field of nanotechnology for solar energy utilization. The course begins with a brief introduction of fundamentals of nanotechnology and solar energy. Then photon (light) management is discussed in detail, followed by a thorough description of conversion of light into electric energy (photovoltaics) and chemical energy (artificial photosynthesis). Detailed discussion of environmental remedy is covered too. Other applications such as thermoelectricity and thermochemistry are presented in the final session.*

**Schedule of the course**

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| |  |  |  | | --- | --- | --- | | *Section* | *Content* | *Hours* | | *1* | *Chapter 1. Fundamentals of nanotechnology and solar energy*  *Chapter 2. Optical properties of nanomaterials and nanostructures* | *4* | | *2* | *Chapter 3. Light harvesting and conversion* | *4* | | *3* | *Exercise I & Student presentation I* | *4* | | *4* | *Chapter 4. Photovoltaic device physics on the nanoscale* | *4* | | *5* | *Chapter 5. Inorganic photovoltaic devices* | *4* | | *6* | *Chapter 6. Organic solar cells*  *Chapter 7. Dye-sensitized & perovskite solar cells* | *4* | | *7* | *Exercise II & Student presentation II* | *4* | | *8* | *Chapter 8. Photosynthesis and bioenergy*  *Chapter 9. Fundamentals of photocatalysis* | *4* | | *9* | *Chapter 10. Water splitting* | *4* | | *10* | *Chapter 11. Photoreduction of carbon dioxide* | *4* | | *11* | *Chapter 12. Environmental remediation (organic pollutants, heavy metals, water purification, etc.)* | *4* | | *12* | *Exercise III & Student presentation III* | *4* | | *13* | *Chapter 13. Thermoelectricity*  *Chapter 14. Thermochemistry* | *4* | | *14* | *Chapter 15. Energy storage*  *Chapter 16. Photodetection and imaging*  *Chapter 17. Summary and outlook* | *4* | | *15* | *Exercise IV & Student presentation IV* | *4* | | *Total* |  | *60* | |

**Textbook and related documents:**

*No specific textbooks, though the following ones are listed. More reading materials will be provided during the lecture.*

*Nanostructured and photoelectrochemical systems for solar photon conversion, Edited by Mary D. Archer and Arthur J. Nozik, Imperial College Press, London, 2009*

*Nanostructured materials for solar energy conversion, Edited by Tetsuo Soga, Elsevier Science, 2007*

*Nanotechnology for Photovoltaics, Edited by Loucas Tsakalakos, CRC Press, Boca Raton, 2010*

**Course title**

**Nano Electronic Materials**

**Instructor(s)-in-charge:**

*Prof. XIE Liming*

**Course type:**

*Lecture*

**Course Assessment:**

*Homework: 12 assignments*

**Grading Policy:**

*Typically 20% attendance, 20% in-class performance, 40% homework, 20% final.*

**Course Prerequisites:**

*Solid state physics, physical chemistry*

**Catalog Description:**

*This course will first give a general review on nano electronic materials, including structure, synthesis and properties. And then introduce typical nano electronic materials in details. The typical nano electronic materials include quantum dots, nanowires, carbon nanotubes, graphene, two-dimensional materials beyond graphene.*

**Schedule of the course**

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| |  |  |  | | --- | --- | --- | | section | content | hours | | 1 | Motivation and surface effect | 4 | | 2 | Quantum confinement effect | 4 | | 3 | Synthesis methods of nano electronic materials | 4 | | 4 | Characterization methods | 4 | | 5 | Characterization methods | 4 | | 6 | Device fabrication techniques | 4 | | 7 | Electrical measurement | 4 | | 8 | Quantum dots | 4 | | 9 | Nanowires | 4 | | 10 | Carbon nanotubes | 4 | | 11 | Graphene | 4 | | 12 | Transition-metal dichalcogenides and Other 2D materials | 4 | | 13 | Presentation skills and discussion | 4 | | 14 | Presentations by students | 4 | | 15 | Presentations by students | 4 | | total |  | 60 | |

**Textbook and any related course materials:**

1. **Introduction to the Physics of Nanoelectronics**, Edited by: S.G. Tan and M.B.A. Jalil, ISBN: 978-0-85709-511-4
2. **Fundamentals of Nanoelectronics**, Edited by: George W. Hanson, ISBN-10: 0131957082
3. **Nanotechnology and Nanoelectronics: Materials, Devices, Measurement Techniques**, Edited by: W. R. Fahrner, ISBN 3-540-22452-1

**Expected level of proficiency from students entering the course:**

*Mathematics: strong*

*Physics: strong*

*Chemistry: strong*

**Course title**

**Plate Tectonics and Evolution of Tibetan Plateau**

**Instructor(s):**

*Prof. Lin Ding et al.*

**Course type:**

*Lecture*

**Course type:**

*Lecture*

**Catalog Description:**

*Plate tectonics is the integrated theory of how the large-scale geologic structures on Earth are created. Plates are created where they separate and recycled where they converge, in a continuous process of creation and destruction. The lithosphere—Earth's strong, rigid outer shell of rock—is broken into about a dozen plates, which slide by, converge with, or separate from each other as they move over the weaker, ductile asthenosphere. Continents, embedded in the lithosphere, drift along with the moving plates. The theory of plate tectonics describes the movement of plates and the forces acting between them. This moving and other related concepts cause all the physical features that we see on the planet: mountain ranges, deep canyons, large continents separated by wide and deep oceans. To begin our explanation of the key elements of plate tectonics theory, we will learn about the physical and chemical structures of the earth, three types of plate boundaries, subduction zones and other special locations on plates. We will see how continents break apart, how they collide, and what makes plates move. Because plate tectonics theory is geology’s grand unifying theory, it is now an essential foundation for the discussion of all geology.*

*Collision between India and Asia was perhaps the most spectacular geological event to occur over the last 500 million years ago (Ma). However, although there are numerous records of ocean closures and continental collisions in geological history, the connection between India and Asia has attracted a great deal of attention because of the resultant formation of the vast and high-altitude Tibetan Plateau. The ongoing process of collision also affected Tibet as well as central and southeast Asia. As a result, collision between India and Asia as the resultant formation of the Tibetan Plateau likely includes a number of unique processes of both continental collision and mechanisms of intracontinental deformation. The initial collision between India and Asia also provides important data to studies of continental lithospheric deformation, environmental change, and paleoaltitude reconstruction. Thus, this collision has significance to our understanding of plate tectonics, continental dynamics, and multilayer interactions. It will cover the following topics:*

**Schedule of the course**

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| |  |  |  | | --- | --- | --- | | Section | Content | hours | | 1 | **Plate tectonics and its developing history**   1. Introduction to Plate Tectonics 2. The Structure of the Earth 3. Three Layers 4. Physical Properties 5. Chemical Compositions 6. Continental Drift 7. Principal Observations 8. The Implications 9. Seafloor Spreading 10. Seafloor Topography 11. Age of the Seafloor 12. Oceanic Ridge System 13. Accreting Plate Boundaries 14. [Divergent](http://www.so.com/link?url=http%3A%2F%2Fgeology.com%2Fnsta%2Fdivergent-plate-boundaries.shtml&q=teaching+plate+tectonics&ts=1479720858&t=f3cdf58048db6fe447bc8aeedf1e8ba&src=haosou)Plate Boundaries 15. [Convergent](http://www.so.com/link?url=http%3A%2F%2Fgeology.com%2Fnsta%2Fdivergent-plate-boundaries.shtml&q=teaching+plate+tectonics&ts=1479720858&t=f3cdf58048db6fe447bc8aeedf1e8ba&src=haosou)Plate Boundaries 16. Transform Plate Boundaries 17. Subduction 18. Distribution of Subduction zones 19. Deep Structure of the Subduction Zones 20. Continents 21. The Growth of Continents 22. Continental Margins 23. Hotspots and Mantle Plumes 24. Mantle Convection 25. Surface Volcanisms 26. Deep Origin of Mantle Plumes 27. The Wilson Cycle 28. Traditional Wilson Cycle Model 29. The Implications 30. Planetary Perspective 31. The Early History 32. Comparative Planetary | 12 | | 2 | **Petrology and Plate Tectonics**  1. Introduction to Petrology and Plate Tectonics  1.1 Material composition of the Earth:  -the Earth’s interior (Crust, Mantle and Core; five principal mechanical subdivisions: Lithosphere, Asthenosphere, Mesosphere, Outer core, Inner core);  -the Earth’s inorganic chemistry (seven most common elements);  -the Earth’s ordered character (common rock-forming minerals).  -the Earth’s three main types of rocks (Igneous, Metamorphic, Sedimentary)  1.2 What’s the petrology?  -Definition (Studying the genesis of the rocks: Igneous petrology, Metamorphic petrology, Sedimentary petrology)  -Transformation among the three main types of rocks  1.3 Research methods  -Field works (Collecting samples/field trip)  -Laboratory works (Determination of chemical composition, Dating methods, Thermobarometry methods and others)  1.4 Plate Tectonics Review  -Plate move evidence  -Plate boundaries  1.5 Rocks in plate boundaries  -Diverging boundaries (e.g. mid-ocean ridges)  -Convergent boundaries (e.g. subduction zone)  1.6 Rocks in inner plate  -Ocean basin  -Continental basin  2. Igneous Petrology  2.1 Fundamental concepts  -magma/melts, fractional crystallization, eruption, emplacement, intrusive rocks, volcanic rocks, volcano, dike, country rocks  2.2 Common rocks  -granite, andesite, basalt  2.3 Magma Generation  -composition, temperature, pressure and fluids  -partial melting of mantle  2.4 Magmatism and Plate Tectonics  -Mid-Ocean Ridges  -Intra-continental Rifts  -Island Arcs  -Active Continental Margins  -Back-Arc Basins  -Ocean Island  -Miscellaneous  -Intra-Continental Activity  3. Metamorphic Petrology:  3.1Fundamental concepts  -metamorphic rock, metamorphism  3.2 Subduction-related “Paired metamorphic belts”  3.3 P-T-t path and contributions to Plate tectonics  4. Sedimentary Petrology:  4.1 Fundamental concepts  -sedimentary rock, sedimentation, sedimentology, sedimentary facies  4.2 Common rocks  -mudstone, sandstone, limestone  4.3 “Bouma sequence” and “Galileo’s free fall”  4.4 “Facies” and Palaeoenvironments  5. “Ophiolite”  5.1 What’s ophiolite?  -a Special Suite of three types of rocks  5.2 Contribution to the Tibetan Plateau | 12 | | 3 | **Paleomagnetism and Plate Tectonics**   1. Introduction to Geomagnetism 2. Earth Magnetic Field 3. History 4. Study Fields 5. Basic Rock Magnetism 6. Magnetic Properties 7. Magnetic Mineralogy 8. Magnetic Domains 9. Hysteresis 10. Natural Remanent Magnetism (NRM) 11. Sampling, Measurement, Analysis and Field Tests 12. Collection of Paleomagnetic Samples 13. Demagnetization Techniques 14. Display and Bedding-tilt Correction 15. Identification of Ferromagnetic Minerals 16. The Fold Test 17. Synfolding Magnetization 18. Conglomerate Test 19. Reversals Test 20. Baked Contact and Consistency Tests 21. Other Tests 22. Magnetic Reversals and Inclination Shallowing 23. Magnetic Reversals 24. Paleomagnetic Geochronlogy 25. Inclination Shallowing 26. Plate Tectonics and Sea Floor Spreading 27. Plate Tectonic Theory and Paleomagnetism 28. Sea Floor Spreading Hypothesis and Paleomagnetism 29. Paleomagnetic Poles and Paleogeographic Reconstruction 30. Procedure for Pole Determination 31. Types of Poles 32. Sampling of Geomagnetic Secular Variation 33. Paleogeographic Reconstruction 34. Regional Tectonics-Collision and Shortening 35. Evolution of the Tibetan Plateau and Tethys 36. India-Asia Collision Time and Shortening 37. Regional Tectonics-Regional Rotations 38. Rotations of the NE Tibetan Plateau 39. Rotations of the SE Tibetan Plateau 40. Rotations of the Tibetan Plateau | 12 | | 4 | **Fundamentals of geodynamics**  1. A brief introduction on geodynamics  1.1 The deforming earth  1.2 Plate tectonics: what it can tell us?  1.3 What is geodynamics?  1.4 What this course will tell you?  2. Stress and strain in solids  2.1 Force and stress  2.2 Stress state in 2D and 3D  2.3 Pressure in the deep interiors of the earth  2.4 Strain  2.5 Measurements of stress and strain  3. Elasticity and flexure of the solid earth  3.1 Linear elasticity  3.2 Uniaxial stress and strain  3.3 Plane stress and strain  3.4 Pure and simple shear  3.5 Bending and flexure of plate in two dimensions  3.6 Flexure with basin and mountain tectonics  4. Rock Rheology  4.1 Diffusion creep  4.2 Dislocation creep  4.3 Temperature- and stress-dependent rheology  4.4 Crustal rheology and viscoelasticity  4.5 Mantle convection and plate motions  5. Faulting  5.1 Classification of Faults  5.2 Mohr-circle theory  5.3 Friction on faults  5.4 Anderson theory of faulting  5.5 Coulomb failure criterion and strength envelop  5.6 Earthquake faulting  6. Geodynamic remarks of on the Tibetan plateau  6.1 Deformation from plate boundary to plate interior  6.2 Decadal to millennia time-dependent deformation  6.3 Available geodynamic models of the Tibetan plateau | 12 | | 5 | **Plate Tectonic in Tibet Plateau**   1. Introduction of the Tibet plateau    1. Why is the Himalayan-Tibetan orogen so wide?    2. Why is the Tibetan Plateau so flat?    3. Why are the boundarys so steep?    4. Why is the Tibetan plateau just so high and no higher? 2. The process of Gondwana split and the Asian continent aggregation    1. The Gondwana super continent    2. The split of the Gondwana    3. The suture zones and aggregation in Tibet 3. India and Eurasia collision    1. Methods to constrain the initial timing of collision   High Pressure-Ultra High Pressure continental metamorphism  Ophiolite obduction  Cessation of marine sedimentation  Molasse basin  Mid-ocean ridge spreading rate  Change in direction of plate motion  Strike slip faults  Crustal deformation  Apparent polar wander path (APWP)  Peripheral foreland basin  Leucogranite  Magmatic transition from oceanic to continental subduction  Faunal migration  Numerical and physical simulations   * 1. History of research on the initial timing of Indian and Asian collision   2. Deformation of the northern THS in the early collisional stage   3. Foreland basin system   4. Collision patterns and suturing processes between the Indian and Asian continents  1. The Raising of Tibet plateau    1. Index of paleoelevation    2. The raising of Himalaya    3. The raising of Tibet | 8 | | 5 | Exam of Oral Presentation: I EXPECT you to be creative and raise novel. | 4 | | Total |  | 60 | |

**Course title**

**Physical Geography**

**Instructor(s):**

*Prof. XiaoMin Fang et al.*

**Course type:**

*Lecture*

**Catalog Description:**

*Physical Geography 2020 spring semester is designed as an introduction course**for research graduate students majored in the earth and environmental sciences. As a foundation in the study of geography, this course introduces the physical elements of the earth and the environment in which people live. The focus is on natural processes that create physical diversity on the earth, covering topics like weather and climate, vegetation and soils, landforms, ecosystems, their distribution and significance. This course is designed in an interactive way, combining basic theories and current research progress in several key fields. It enables the students to develop a broad understanding of geographic processes, and how human activity affects physical geography, especially in the Tibetan Plateau. The course is structured as a series of lectures with the topics listed as following:*

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| |  |  | | --- | --- | | Section | Content | | 1 | **Introduction of Physical Geography**  1.1 Brief introduction  1.2 The earth and its rotation  1.3 Coordination system  1.4 The earth in the solar system | | 2 | **Global Energy Balance**  2.1 Insolation to the earth  2.2 Global energy system  2.3 Energy redistribution and climate change | | 3 | **Air Temperature, Moisture and Precipitation**  3.1 Air temperature and vertical temperature structure  3.2Temperature change  3.3 Moisture and humidity  3.4 Precipitation formation and types | | 4 | **Global Climates and Climate Change**  4.1 Climate and classification  4.2 Climate with latitude  4.3 Climate change and causes  4.4 Climate change impacts | | 5 | **Winds and Global Circulation**  5.1 Air pressure, wind and cyclones-anticyclones  5.2 Wind circulation  5.3 Ocean circulation | | 6 | **Weather Systems**  6.1 Air masses and fronts  6.2 Midlatitude anticyclones an cyclones  6.3 Tropic and equatorial weather systems | | 7 | **Earth materials**  7.1 The structure of the earth  7.2 Earth materials and rocks | | 8 | **Tectonics and Landforms**  8.1 Plate tectonics and global topography  8.2 Tectonic landforms  8.2 Volcanic activity and landforms | | 9 | **Weathering and Mass Wasting**  9.1 Weathering  9.2 Mass Wasting  **Freshwater of the Continents**  10.1 Hydrologic Cycle  10.2 Groundwater | | 10 | 10.3 Streamflow  10.4 Lakes  10.5 Hydrological Model  10.6 Water as a Natural Resource | | 11 | **Landforms Made by Running Water**  11.1 Erosion, Transportation, and Deposition  11.2 Stream Gradation and Evolution  11.3 Fluvial Landforms  11.4 Fluvial Processes in an Arid Climate | | 12 | **Global Biogeography and Biogeographic Process**  12.1 Global Natural Vegetation and Climatic Belts  12.2 Terrestrial Ecosystem-Components, structure and function  12.3 Energy and Matter Flow in Ecosystem  12.4 Biodiversity  12.5 Human Disturbance to Natural Ecosystem  12.6 Methods of Ecosystem Studies | | 13 | **Global Soils**  13.1 The Nature of the Soil  13.2 Soil Chemistry  13.3 Soil Moisture  13.4 Soil Development  13.5 The Global Scope of Soils | | 14 | **Landforms Made by Wave and Wind**  14.1 The Work of Waves and Tides  14.2 Coastal Landforms  14.3 Wind Action  14.4 Eolian Landforms | | 15 | **Glacial and Periglacial Landforms**  15.1 Glaciers and Their Types  15.2 Glacial Processes and Their Landforms  15.3 Periglacial Processes and Landforms  15.4 Glaciations and Climatic Changes | |

**Course title**

**Global Change Ecology**

**Instructor(s)-in-charge:**

*Prof. WANG Tao et al.*

**Course type:**

*Lecture*

**Grading Policy:**

*The grading for this course will be based on:*

*- Participation (30% of grade)*

*- Report (70% of grade)*

*\*Participation in lectures, discussions, and other activities is an essential part of the instructional process. Students are expected to attend class regularly. Those who are compelled to miss class should inform the instructor of the reasons for absences. Unexcused late assignments will have at a minimum 5 points deducted. To avoid this penalty you must contact the instructor prior to the due date. Each student should be expected to give a report at the end of the course.*

**Course Prerequisites:**

*This course does not have any pre-requisites.*

**Catalog Description:**

*This course is designed as an introductory course in ecology for graduate students majored in Earth Sciences. The class is intended to provide an introduction to main ecological processes, with particular attention to the responses of these processes to global change at local, regional, and global scales. It will also introduce the basic principles of local field measurement techniques, remote sensing, and land surface modeling in relation to carbon and nitrogen cycles. The course is structured as a series of lectures in which individual research cases are discussed with faculty tutors. It will cover the following topics:*

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| |  |  |  | | --- | --- | --- | | Section | Content | hours | | 1 | **Introduction of global change ecology** | 4 | | 2 | **Plant ecophysiological response**  2.1 Concepts  2.2 Methods - controlled experiment and stable isotope record  2.3 Responses to elevated CO2 and nitrogen availability  2.4 Responses to warming and drought  2.5 Impacts of multiple factors and their interaction | 8 | | 3 | **Responses of terrestrial ecosystems**  3.1 Forests  3.1.1 Cambial activity and wood structure of trees  3.1.2 Elevational and latitudinal distribution of forests  3.1.3 Global change and forest growth  3.2 Grasslands  3.2.1 Plant phenology  3.2.2 Plant composition and diversity  3.2.3 Plant production and decomposition  3.2.4 Greenhouse gas fluxes  3.2.5 Carbon sequestration  3.3 micro-organisms  3.3.1 The origin and evolution of microorganims  3.3.2 Classification of microorganims  3.3.3 The role of microorganims in the response of terrestrial ecosystems to climate change  3.3.4 Methods: controlled microcosms experiments and field investigation  3.3.5 Methods to study the microbial ecology  3.3.6 Responses to warming, precipitation and drought  3.3.7 Responses to eCO2 and N availability (GeoChip or high throughput seq) | 24 | | 4 | **Regional and global responses**  4.1 Approaches: Satellite observations  4.2 Approaches: Land surface modeling  4.3 Terrestrial vegetation dynamics  4.4 Carbon cycle  4.5 Nitrogen cycle | 20 | | 5 | **Mitigation and adaption**  5.1 Concepts  5.2 Land use and reduce of GHG emissions  5.3 Accounting methodology of GHG reduction and monitoring  5.4 Carbon trade | 4 | | Total |  | 60 | |

**Course title**

**Climate Change**

**Instructor(s)-in-charge:**

*Prof. Dr.MA Yaoming et al.*

**Course type:**

*Lecture*

**Course Schedule:**

*4hrs/week by instructor.*

**Course Assessment:**

*Homework: 4 assignments for each instructor*

**Grading Policy:**

*Typically 60% homework (each instructor’s report), 20% each midterm, 20% final.*

**Course Prerequisites:**

*Atmospheric science, general climate change knowledge*

**Catalog Description:**

*Climate Change 2020 spring semester is designed as an introductory course plus our research aspect in ITP and IAP CAS (Institute of Tibetan Plateau, and Institute of Atmospheric Physics, Chinese Academy of Sciences) in the Climate Change for graduate students majored in Earth Sciences. This class is a synthesis of current knowledge of the climate system and past and present climates. It provides solid background information and includes critical assessments of issues that remain incompletely understood. There, it is up to the students to logically evaluate climate change issues presented daily by the media. This class will introduce related reference for climate researchers and students, especially for issues of climate change in Earth system. The class presents the basics surrounding climate change in a simple way while pointing out the complexity of climate data collection, processing, and interpretation. Our research aspect in ITP and IAP CAS will introduce climate change related topics, for example, land surface heat flux retrieve from in-situ data, satellite remote sensing data and numerical model; land surface model development and data assimilation; black carbon in the mountain glacier area; hydrological model, Asian monsoon simulation and so on. All of these topics will enhance our theoretical questions about climate change, especially in the Tibetan Plateau.*

**Schedule of the course**

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| |  |  |  | | --- | --- | --- | | Section | Content | hours | | 1 | **Overview of Climate Change**  1.1 Weather and climate  1.2 What do we mean by climate variability and climate change?  1.3 Connections, timescales and uncertainties  1.4 The big picture | 4 | | 2 | **Radiation and the Earth’s energy balance**  2.1 Solar and terrestrial radiation  2.2 Solar variability  2.3 Summary | 4 | | 3 | **The elements of the climate**  3.1 The atmosphere and oceans in motion  3.2 Atmospheric circulation patterns  3.3 Radiation balance  3.4 The hydrological cycle  3.5 The biosphere  3.6 Sustained abnormal weather patterns  3.7 Atmosphere–ocean interactions  3.8 The Great Ocean Conveyor  3.9 Summary | 4 | | 4 | **Evidence of climate change**  8.1 Peering into the abyss of time  8.2 From greenhouse to icehouse  8.3 Sea-level fluctuations  8.4 The ice ages  8.5 The end of the last ice age  8.6 The Holocene climatic optimum  8.7 Changes during times of recorded history  8.8 The medieval climatic optimum  8.9 The Little Ice Age  8.10 The twentieth-century warming  8.11 Concluding observations | 4 | | 5 | **The natural causes of climate change**  6.1 Auto-variance and non-linearity  6.2 Atmosphere–ocean interactions  6.3 Ocean currents  6.4 Volcanoes  6.5 Sunspots and solar activity  6.6 Tidal forces  6.7 Orbital variations  6.8 Continental drift  6.9 Changes in atmospheric composition  6.10 A belch from the deep  6.11 Catastrophes and the ‘nuclear winter’  6.12 Summary | 4 | | 6 | **Human activities**  7.1 Greenhouse gas emissions  7.2 Dust and aerosols  7.3 Desertification and deforestation  7.4 The ozone hole  7.5 Summary | 4 | | 7 | **The measurement of climate change**  7.1 In situ instrumental observations  7.2 Satellite measurements  7.3 Re-analysis work  7.4 Historical records  7.5 Proxy measurements  7.6 Dating  7.7 Isotope age dating  7.8 Summary | 4 | | 8 | **Statistics, significance and cycles**  8.1 Time series, sampling and harmonic analysis  8.2 Noise  8.3 Measures of variability and significance  8.4 Smoothing  8.5 Wavelet analysis  8.6 Multidimensional analysis  8.7 Summary | 4 | | 9 | **Consequences of climate change**  9.1 Geological consequences  9.2 Flora and fauna  9.3 Mass extinctions  9.4 Sea levels, ice sheets and glaciers  9.5 Agriculture  9.6 The historical implications of climatic variability  9.7 Spread of diseases  9.8 The economic impact of extreme weather events  9.9 Summary | 4 | | 10 | **Climate modeling context and system**  10.1 Basic processes of climate modeling  10.2 Understanding climate change  10.3 Climate modeling and weather forecasting  10.4 Framework of climate models  10.5 Climate model development | 4 | | 11 | **Climate modeling, projection and uncertainties**  11.1 Coupled Model Inter-comparison Project (CMIP)  11.2 Climate ensemble  11.3 Modeling historical climate change  11.4 Projecting future climate change  11.5 Modeling biases and uncertainties  11.6 Improving climate modeling over the TP  11.7 Simulation over the TP and Asian summer monsoon | 4 | | 12 | **Hydrological modelling and its applications for integrated water resources management** | 4 | | 13 | **Simulation of the climate change of Asian summer monsoon**  13.1 Impact of Land-sea distribution on Asian summer monsoon formation  13.2 Impact of Tibetan Plateau  13.3 Climate change of Asian summer monsoon  13.4 Simulation of the Tibetan Plateau impacts | 4 | | 14 | **Back carbon in the glacier area** | 4 | | 15 | **Land surface heat flux retrieve from in-situ data, remote sensing data and numerical model** | 4 | | Total |  | 60 | |

**Contents of the course**

*Content*

***Overview of Climate Change***

*1.1 Weather and climate*

*1.2 What do we mean by climate variability and climate change?*

*1.3 Connections, timescales and uncertainties*

*1.4 The big picture*

***Radiation and the Earth’s energy balance***

*2.1 Solar and terrestrial radiation*

*2.2 Solar variability*

*2.3 Summary*

***The elements of the climate***

*3.1 The atmosphere and oceans in motion*

*3.2 Atmospheric circulation patterns*

*3.3 Radiation balance*

*3.4 The hydrological cycle*

*3.5 The biosphere*

*3.6 Sustained abnormal weather patterns*

*3.7 Atmosphere–ocean interactions*

*3.8 The Great Ocean Conveyor*

*3.9 Summary*

***The measurement of climate change***

*4.1 In situ instrumental observations*

*4.2 Satellite measurements*

*4.3 Re-analysis work*

*4.4 Historical records*

*4.5 Proxy measurements*

*4.6 Dating*

*4.7 Isotope age dating*

*4.8 Summary*

***Statistics, significance and cycles***

*5.1 Time series, sampling and harmonic analysis*

*5.2 Noise*

*5.3 Measures of variability and significance*

*5.4 Smoothing*

*5.5 Wavelet analysis*

*5.6 Multidimensional analysis*

*5.7 Summary*

***The natural causes of climate change***

*6.1 Auto-variance and non-linearity*

*6.2 Atmosphere–ocean interactions*

*6.3 Ocean currents*

*6.4 Volcanoes*

*6.5 Sunspots and solar activity*

*6.6 Tidal forces*

*6.7 Orbital variations*

*6.8 Continental drift*

*6.9 Changes in atmospheric composition*

*6.10 A belch from the deep*

*6.11 Catastrophes and the ‘nuclear winter’*

*6.12 Summary*

***Human activities***

*7.1 Greenhouse gas emissions*

*7.2 Dust and aerosols*

*7.3 Desertification and deforestation*

*7.4 The ozone hole*

*7.5 Summary*

***Evidence of climate change***

*8.1 Peering into the abyss of time*

*8.2 From greenhouse to icehouse*

*8.3 Sea-level fluctuations*

*8.4 The ice ages*

*8.5 The end of the last ice age*

*8.6 The Holocene climatic optimum*

*8.7 Changes during times of recorded history*

*8.8 The medieval climatic optimum*

*8.9 The Little Ice Age*

*8.10 The twentieth-century warming*

*8.11 Concluding observations*

***Consequences of climate change***

*9.1 Geological consequences*

*9.2 Flora and fauna*

*9.3 Mass extinctions*

*9.4 Sea levels, ice sheets and glaciers*

*9.5 Agriculture*

*9.6 The historical implications of climatic variability*

*9.7 Spread of diseases*

*9.8 The economic impact of extreme weather events*

*9.9 Summary*

***Context of climate modeling***

*Climate modeling system*

*Coupled Model Inter-comparison Project (CMIP)*

*Historical climate modeling*

*Future climate projection*

*Uncertainties in climate modeling*

**Textbook and any related course material:**

*Climate Change-A Multidisciplinary Approach (Second Edition), By William James Burroughs.*

*Cambridge University Press, 2007, 378 pages, ISBN 978-0-52169-033-1*

**Expected level of proficiency from students entering the course:**

*Earth science: strong*

*Atmospheric science: strong*

**Course title**

**Chemical Reaction Engineering**

**Instructor(s)-in-charge:**

*Prof. Li Chunshan, Prof. Xu Baohua, Associate Prof. Li Minjie*

**Course type:**

*Lecture*

**Course Assessment:**

*Homework: 6 assignments, will be given after each class, extensive literature reading is expected.*

**Grading Policy:**

*Assignments 40%, Final 40%, Attendance 20%*

**Course Prerequisites:**

*College Chemistry, College Mathematics, English.*

**Catalog Description:**

*The course is mainly focusing on the essentials of kinetics, catalysis and chemical reactor engineering. The main issue of chemical reaction engineering is to analyze the physical chemistry of sub-processes in a reactor by a mathematical model method. Each process is expressed as an appropriate mathematical expression, thereby providing the analytical solution or numerical solution. Various typical reaction types and the proper reactor design theory will be introduced.*

**Schedule of the course 20×3**

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| |  |  |  | | --- | --- | --- | | section | content | hours | | 1 | Introduction of Chemical Reaction Engineering. | 4 | | 2 | Homogeneous Reaction Kinetics | 4 | | 3 | The Kinetics of Gas-Solid Phase Catalysis | 4 | | 4 | Macro-Kinetics of Gas-Solid Phase Catalysis | 4 | | 5 | Autoclave Type and Homogeneous Tubular Reactor | 6 | | 6 | Gas-Solid Phase Catalytic Reaction Fixed Bed Reactor | 6 | | 7 | Gas-Solid Phase Catalytic Reaction Fluidized Bed Reactor | 6 | | 8 | Gas-Liquid Reaction and Bubbling Reactor | 6 | | 9 | The Gas-Liquid Reaction Process and the Reactor | 4 | | 10 | Liquid-Solid Reaction and Fluidized Bed Reactor | 4 | | 11 | Gas-Liquid-Solid Reaction Engineering | 4 | | 12 | Safety of chemical reaction process | 4 | | 13 | Design of reactor, examination | 4 | | Total |  | 60 | |

**Textbook and any related course material:**

*No textbook, and electronic course reading materials will be provided one week before each class.*

**Course title**

**Energy Chemistry and Energy Chemical Industry**

**Instructor(s)-in-charge:**

*Prof. Li, Songgeng, Associate prof, Fan, Chuigang*

**Course type:**

*Lecture*

**Course Assessment:**

*Homework: 10 assignments*

**Grading Policy:**

*Assignments 40%, Final 40%, Attendance 20%*

**Course Prerequisites:**

*Familiar with the basic knowledge of Chemistry, Thermodynamics, and Flow and Transport Process.*

**Catalog Description:**

*This course covers the fundamentals of energy conversion in thermomechanical, thermochemical, electrochemical, and photoelectric processes with emphasis on efficiency, environmental impact and performance. The topics include coal utilization, petro chemistry, bio-energy, fuel cell, battery and some new energy resources like hydrogen, solar, etc. Systems utilizing fossil fuels, renewable resources and hydrogen over a range of sizes and scales are discussed. Different forms of energy storage and transmission are also involved in this course.* *It is expected that after taking this course, students will be familiar with basic chemistry principles on energy processing, and most common energy processing technologies together with some environmental issues related.*

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| |  |  |  | | --- | --- | --- | | section | content | hours | | 1 | Energy chemistry: a general review | 4 | | 2 | Coal conversion: part I : pyrolysis and gasification | 4 | | 3 | Coal conversion: part II: liquefaction and combustion | 4 | | 4 | Petroleum processing | 4 | | 5 | Processing technologies for natural gas and unconventional hydrocarbon resources | 4 | | 6 | Bioenergy: fundamentals and application I | 4 | | 7 | Bioenergy: fundamentals and application II | 4 | | 8 | Pollutants formation and control in energy conversions | 4 | | 9 | Solar energy: basic principles, direct utilization, photoelectric conversion, chemical conversion | 4 | | 10 | Hydrogen: features of hydrogen, storage tech. applications and relative technologies. | 4 | | 11 | Fuel cell: overview, fundamentals, AFC, PEMFC, DMFC,SOFC, flow cell, others | 4 | | 12 | Geothermal utilization | 4 | | 13 | Wind energy and Ocean energy: | 4 | | 14 | Energy storage technologies I : Batteries | 4 | | 15 | Energy storage technologies II: Other technologies | 4 | | **Total** |  | **60** | |

**Textbook and any related course material:**

*Ripudaman Malhotra, Fossil Energy, Springer, 2013,*

*Handbook of Alternative Fuel Technologies, CRC Taylor & Francis, 2015*

*Giafranco Pistoia, Battery Operated Devices and Systems，Elsevier, 2009*

**Course title**

**Green Chemistry and Engineering**

**Instructor(s)-in-charge:**

*Prof. Zhang, Guangjin,*

**Course type:**

*Lecture*

**Course Assessment:**

*Homework: 10 assignments, presentations*

**Grading Policy:**

*Assignments 40%, Final 40%, Attendance 20%*

**Course Prerequisites:**

*Familiar with the basic knowledge of Chemistry, Thermodynamics.*

**Catalog Description:**

*The purpose of this course includes: Increase the interest to Chemistry and Chemical Engineering, extend scope of knowledge, make the idea of “Green” into mind. Knowing the basic knowledge of green chemistry and engineering, the definition, developments, theory and some examples; Getting the ideas on how to develop a green process and can applied the learned knowledge in your further research works. The topics include basic principles of green chemistry, task of green chemistry, Catalysis and Green Chemistry. Biocatalysis, Photo/electrical Catalysis, Solid catalyst, Acid and base, Ionic liquid and other non-organic solvents, Chemical separation, Alternate Energy sources, New synthetic route, Functional materials, Design of safe and harmless chemicals.*

**Schedule of the course**

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| |  |  |  | | --- | --- | --- | | section | content | hours | | 1 | Green Chemistry: a general review | 4 | | 2 | Task of green chemistry | 4 | | 3 | Green chemistry and catalysis | 4 | | 4 | biocatalysis | 4 | | 5 | Photo-catalysis | 4 | | 6 | Electro-catalysis | 4 | | 7 | Solid catalyst, Acid and Base | 4 | | 8 | Ionic liquid and other non-organic solvents | 4 | | 9 | Chemical separation | 4 | | 10 | Working without organic solvent | 4 | | 11 | Agrochemicals | 4 | | 12 | Sustainable materials | 4 | | 13 | Design of safe and harmless chemicals | 4 | | 14 | chemistry of long wear | 4 | | 15 | examination | 4 | | **Total** |  | **60** | |

**Textbook and any related course material:**

*Mukesh Doble, Green Chemistry and Processes,elsevier, 2009,*

*Albert Matlack, Introduction to Green Chemistry, CRC Press, 2012*

**Course title**

**Fluidization and Multiphase Flow**

**Instructor(s)-in-charge:**

*Prof. WANG Wei*

**Course type:**

*Lecture*

**Course Assessment:**

*Homework: 2 home exercises are to be solved individually. 2 course assignments are to be solved in groups of 2-3 students and extensive literature reading is expected.*

**Grading Policy:**

*Assignments 40%, Final 40%, Attendance 20%*

**Course Prerequisites:**

*Principle of Chemical Engineering*

**Catalog Description:**

*This course will provide comprehensive knowledge of fluidization and multiphase flow with fundamentals and applications related to chemical engineering and energy conversion. A student who has met the objectives of the course will be able to:*

* *Understand the flow regime of gas-solid flow and state of the art of research and application*
* *Manage basic calculations and solve practical problems related to fluidization*
* *Overview the modeling approached*
* *Design a fluidized bed reactor with preliminary requirement*

**Schedule of the course**

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| |  |  |  | | --- | --- | --- | | section | content | hours | | 1 | Fluidization phenomena and history, multiphase flow-history and development, class exercise | 4 | | 2 | particle characterization, Single particle motion, | 4 | | 3 | flow regime diagram, criteria of transition, particulate and aggregative fluidization, stability analysis, class exercise | 4 | | 4 | Bubbling fluidization, bubble dynamics, | 4 | | 5 | distributor design, entrainment and elutriation | 6 | | 6 | Scale-up and scale-down of fluidized bed | 4 | | 7 | Circulating fluidized bed, generalized fluidization, choking phenomena | 6 | | 8 | cyclone and separation, downer, mixing, mass and heat transfer | 6 | | 9 | Particle-fluid mass transfer and heat transfer, wall-to-bed heat transfer | 4 | | 10 | Introduction to multiphase fluid dynamics, two-fluid model, | 6 | | 11 | Introduction to kinetic theory, drag force, multiscale models | 6 | | 12 | Introduction to simplified solution, bubbling simulation, clustering simulation, reactive simulation, perspective | 4 | | 13 | Final test | 2 | | total |  | 60 | |

**Textbook and any related course material:**

*The textbook mainly refers to:*

*Kunii, D., Levenspiel, O. Fluidization Engineering. Butterworth-Heinemann.1991.*

*Electronic course reading materials will be provided before each class. The following references are recommended, including:*

*Grace, J. et al. Fluidized Beds. Multiphase Flow Handbook. Taylor & Francis. 2006.*

*Gidaspow, D. Multiphase Flow and Fluidization, Academic Press, 1994.*

**Course title**

**Applied Statistics**

**Instructor(s)-in-charge:**

*Assoc. Prof. Qian WANG Email: wangqian@ucas.ac.cn*

**Course type:**

*Lecture*

**Grading Policy:**

*Participation (20%), Homework (40%), Project (40%)*

**Catalog Description:**

*This course is an introduction to applied statistics and data analysis. Topics are chosen from descriptive measures, sampling and sampling distribution, estimation and confidence interval, hypothesis test, linear regression, ANOVA, goodness-of-fit and contingency analysis. Data analysis is difficult without some computing tools and the course will introduce some statistical computing with Excel.*

**Textbook and any related course material:**

1. *Tamhane, Ajit C., and Dorothy D. Dunlop. Statistics and Data Analysis: From Elementary to Intermediate. Prentice Hall, 2000.*
2. *Pawel Lewicki and Thomas Hill. Statistics: Methods and Applications. http://www.ebook3000.com/Statistics--Methods-and-Applications\_21438.html.*

**Course title**

**Academic Communication for International Conferences Instructor(s)-in-charge:**

**Course type:**

*Lecture*

**Grading Policy:**

*1. 40% given to the final group presentations*

*2. 60% given to the attendance, assignments and group reports*

**Schedule of the course**

* *Lecture 1: Course Introduction*
* *Lecture 2: Interview for academic purposes--1*
* *Lecture 3: Interview for academic purposes--2*
* *Lecture 4: Discussion with examples*
* *Lecture 5: Discussion with comparison and contrast*
* *Lecture 6: Discussion with cause-effect*
* *Lecture 7: Presentation—introduction and overview*
* *Lecture 8: Presentation—reporting your research*
* *Lecture 9: Making posters*
* *Lecture 10: Presenting more effectively*
* *Lecture 11: Final Group Presentations*