COURSE CATALOG

2020-2021 Spring Semester

Online

International College of UCAS

目录

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. 20th –Jan. 30th, 2021 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 passport ID
Original password: 123456

Date	Process
Jan. 20-Jan. 30	Register professional courses in Course Selection System
Mar.8	Courses start
Mar.8-Mar.20	Confirm the registration with assistant teacher of each course
Jun. 26	All the courses end

NOTE: The course selection system is just for collecting students' information. It is just the first step. Only after confirming with the teaching assistant can the course be selected successfully.

2. 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.

3. 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.

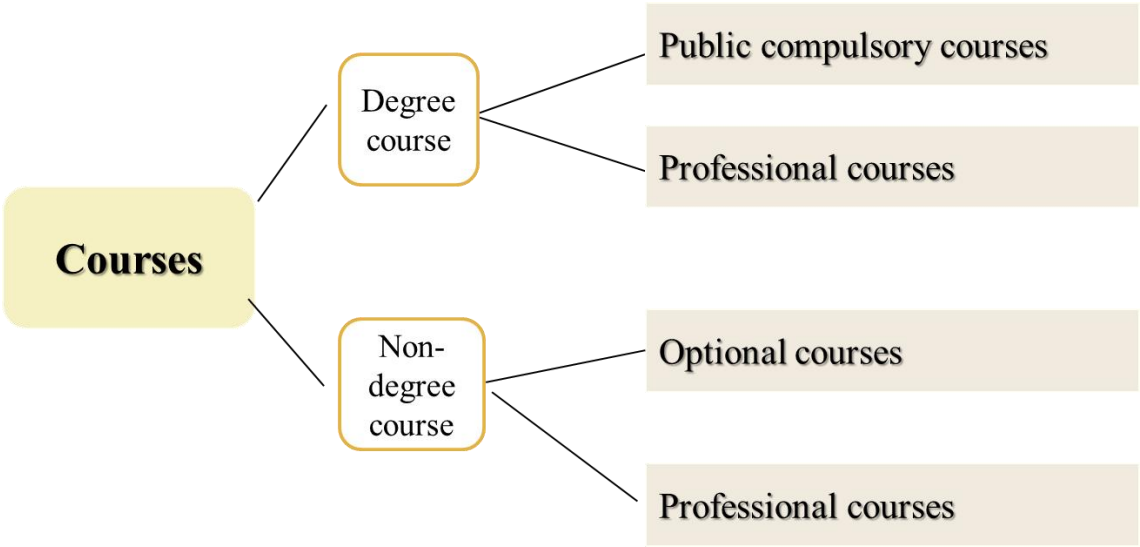
4. General Degree Requirements for MD-PhD Students

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.

Types	Public compulsory courses	Optional courses	Professional degree courses	In total
Masters	**7 credits**	**≥2 credits**	**≥12 credits**	**≥30 credits**
PhD	**7 credits**	**None**	**≥4 credits and ≥2 courses**	**≥9 credits**
MD-PhD	**13 credits**	**≥2 credits**	**≥16 credits**	**≥38 credits**

5. Courses Type

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



5.1 Public compulsory courses (7 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).
(4) Academic Morality and Writing Norms (1 credits).

These four 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 (**except Academic Morality and Writing Norms**).

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)** before the end of September.

5.2 Professional courses—Degree Courses and Non-degree Courses

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.

6. 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 Public compulsory courses are all Degree courses.

7. Contact Information

Education Coordinator for Professional Courses:

- Phone: 010-82680563, Ms. Sophie
- E-mail: hutian@ucas.ac.cn

Education Coordinator for Public compulsory courses:

- Phone: 010-82680986, Ms. Season
- E-mail: dingdanni@ucas.ac.cn

Code	Name	Type	Hours/ Credits	Date&Time	VooV Meeting	Professors	First Class Date	Assistant teacher
0713I0D01001H	Plant Physiology and Ecology	Professional courses	51/3.0	Thur.(13:30-17:10)	ID-43288938501;Code-123456	Qu Laiye	Mar.13th	xyyuan@rcees.ac.cn
0710I0D01006H	Nano-biology	Professional courses	50/3.0	Wed. (08:30-12:10)	ID-89295532179	CHEN Deliang et al.	Mar.10th	yangqifan19@mails.ucas.ac.cn
0710I0D01008H	Molecular Entomology and Plant Pathology	Professional courses	51/3.0	Tue.(13:30-17:10)	ID-40648724376;Code-123676	ZOU Zhen et al.	Mar.9th	jiangh@ioz.ac.cn
0710I0D01009H	Biochemistry	Professional courses	60/4.0	Tue.(08:30-12:10)	ID-54094287777	ZHONG Liangwei et al.	Mar.9th	kongfei18@mails.ucas.ac.cn
0710I0D01013H	Conservation Biology	Professional courses	60/4.0	Tue.(13:30-17:10)	ID-30222352865	JIANG Zhigang	Mar.9th	evansowuor4@gmail.com
0710I0D01007H	Vector and Human Pathogen	Professional courses	51/3.0	Tue.(18:30-22:00)	ID-76595009614	ZHENG Aihua et al.	Mar.9th	zhangxing@ucas.ac.cn
0710I0D01010H	Introduction to Epigenetics and RNA Silencing	Professional courses	60/4.0	Thur.(13:30-17:10)	ID-84635059545	ZHANG Xiaoming et al.	Mar.11th	liqi@ioz.ac.cn
0710I0D01011H	Nanobiological Sensing and Detection	Professional courses	60/4.0	Tue.(14:00-18:00)	ID-97973144401	LI Lele	Mar.9th	zhaojian@nanoctr.cn

0703I0D01002H	Nanotechnology for Solar Energy Utilization	Professional courses	50/3.0	Thur.(13:30-17:10)	ID-82885894952	HE Tao	Mar.11th	wangyanjie@nanoctr.cn
0703I0D01003H	Nano Electronic Materials	Professional courses	52/3.0	Wed.(13:30-17:10)	ID-59962348503	XIE Liming	Mar.10th	wujuanxia@nanoctr.cn
0709I0D01001H	Plate Tectonics and Evolution of Tibetan Plateau	Professional courses	75/5.0	Tue.(13:30-16:20)&Thur.(13:30-16:20)	Tue-72521090029; Thur-55160339501	DING Lin et al.	Mar.11th	flcai@itpcas.ac.cn
0705I0D01001H	Physical Geography	Professional courses	60/4.0	Tue.(13:30-17:10)	ID-62489321538	FANG Xiaomin et al.	Mar.9th	kangjian@itpcas.ac.cn
0713I0D01002H	Global Change Ecology	Professional courses	60/4.0	Wed.(13:30-17:10)	ID-31332849245	WANG Tao et al.	Mar.10th	liu.dan@itpcas.ac.cn
0706I0D01001H	Climate Change	Professional courses	64/4.0	Mon.(08:30-12:10)	ID-99342218639	MA Yaoming et al.	Mar.8th	wqma@itpcas.ac.cn
0817I0D01001H	Chemical Reaction Engineering	Professional courses	60/4.0	Tue.(08:30-12:10)	ID-81469317762;Code-2021	LI Chunshan et al.	Mar.9th	yxia@ipe.ac.cn
0817I0D01003H	Energy Chemistry and Chemical Engineering	Professional courses	60/4.0	Mon.(13:30-17:10)	ID-82138333356;Code-0817	LI Songgeng et al.	Mar.8th	haorongjiang18@mails.ucas.ac.cn

0817I0D01002H	Green Chemical Engineering	Professional courses	60/4.0	Wed.(08:30-12:10)	ID-68216476730	ZHANG Guangjin	Mar.10th	wanghaifan20@mails.ucas.ac.cn
0817I0D01005H	Fluidization and Multiphase Flow	Professional courses	60/4.0	Tue.(13:30-17:10)	ID-47462931836	WANG Wei	Mar.9th	tianyj@ipe.ac.cn
0714I0D01002H	Applied Statistics	Professional courses	50/3.0	Wed.(13:30-17:10)	ID-66874786241	WANG Qian	Mar.10th	15879026322@163.com
0705I0D01007H	Applications of Remote Sensing on Climate Change, Land Science and Severe Weather	Professional courses	60/4.0	Tue(08:30-12:10)	ID-56549658085; Code-123321	QI Youcun et al.	Mar.9th	lidh@igsnrr.ac.cn
0830I0D01005H	Water Chemistry	Professional courses	60/4.0	Tue.(13:30-16:20)&Thur.(13:30-16:20)	Tue-56045268000;Thur-41789375654	DONG Huiyu et al.	Mar.9th	wangao201@mails.ucas.ac.cn
0812I0D01003H	Fundamental for Internet of Things and Its Applications	Professional courses	50/3.0	Mon.(18:30-22:00)	ID-66343525430; Code-010211	YI Weidong	Mar.8th	xieshijun19@mails.ucas.ac.cn
0710I0D01014H	Biodiversity Science	Professional courses	50/3.0	Mon.(13:30-16:20)	ID-98718217959;Code-2021	MA Keping et al.	Mar.8th	niuhs@ucas.ac.cn

0705I0D01006H	Development Geography	Professional courses	60/4.0	Tue.(19:00-21:50)& Satur.(19:00-21:50)	Tue-71892445431; Satur-79846772241	DENG Xiangzheng et al.	Mar.9th	pengl.18b@igsnrr.ac.cn
0710I0D01015H	Integrative Systematic Biology	Professional courses	51/3.0	Fri.(19:00-22:00pm)	ID-33238264694	ZHU Chaodong et al.	Mar.5th	michael.christopher.orr@gmail.com
050200DGX001H-1	Academic Communication for International Conferences	Optional courses	40/1.0	Tue.(08:30-12:10)	ID-71748482924;Code-0901	YU Hua	Mar.9th	zhouyingkun15@mails.ucas.ac.cn
050200DGX001H-2	Academic Communication for International Conferences	Optional courses	40/1.0	Thur.(18:30-22:00)	ID-85133292111	FANG Jiashun	Mar.11th	wangpeng20@mails.ucas.ac.cn

Public compulsory courses

Class No.	Code	Name	Hours/ Credits	Date&Time	VooV Meeting ID	Professors	First Class	Assistant teacher
Y-1	050102DGB002H-1	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(8:30-12:10) Thur.(8:30-12:10)	607 9163 6091 552 3223 2043	LIU Xiaomeng	Mar. 1st	joe06082000@163.com
Y-2	050102DGB002H-2	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(8:30-12:10) Thur.(8:30-12:10)	545 1676 9213 449 3862 9694	HE Fei	Mar. 1st	mengzhilv221@126.com
Y-3	050102DGB002H-3	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(8:30-12:10) Thur.(8:30-12:10)	979 7378 9572 440 6775 5237	LI Ya	Mar. 1st	xiaoying796@163.com
Y-4	050102DGB002H-4	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(8:30-12:10) Thur.(8:30-12:10)	863 6382 4175 470 9451 9056	LI Ran	Mar. 1st	liran1008@126.com
Y-5	050102DGB002H-5	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(8:30-12:10) Thur.(8:30-12:10)	930 1470 1324 809 3647 0785	LUO Lei	Mar. 1st	sonialo@163.com
Y-6	050102DGB002H-6	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(8:30-12:10) Thur.(8:30-12:10)	806 3457 5866 617 8117 8055	LUO Wei	Mar. 1st	luowei_official@163.com
Y-7	050102DGB002H-7	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(8:30-12:10) Thur.(8:30-12:10)	746 3333 8915 706 5376 0013	WANG Lei	Mar. 1st	1625355608@qq.com
A-1		Academic Morality and Writing Norms	20/1.0	Thur.(18:30-22:00)	836 7926 2043 Code:210311	YE Qing	Mar. 11th	caosihe20@mail.ucas.ac.cn
A-2		Academic Morality and Writing Norms	20/1.0	Thur.(18:30-22:00)	836 7926 2043 Code:210311	YE Qing	Apr.29th	
A-3		Academic Morality and Writing Norms	20/1.0	Mon.(14:20-17:10)	634 8356 5581	YU Jun& LAN Li	Mar. 8th	
A-4		Academic Morality and Writing Norms	20/1.0	Mon.(14:20-17:10)	326 5757 6757	YU Jun& LAN Li	Apr.26th	panyitong@aliyun.com

Course title:

Plant Physiology and Ecology

Instructor:

Associate Prof. Laiye Qu

Course type: *Lecture*

Course Assessment:

None

Grading Policy:

Registration (17% of the final score)

one report (50% of the final score)

one quiz (33% 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.	Nitrogen	
8.	Decomposition	
9.	Phosphorus	Report
10.	Mycorrhiza	
11.	Multiple relationship	
12.	Growth and allocation	
13.	Restoration	
14.	Succession	
15.	Plant-soil feedback	
16.	General discussion	
17	Examination	Presentation

Course title

Nano-biology

Instructor(s)-in-charge:

Assoc. Prof. Chen Deliang & Prof. Zhang Zhuqing

Course type:

Lecture

Course Schedule:

See Schedule of the course

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

section	content		hours
1	Introduction to Nanobiology	History, Progress and Objectives of Nanobiogy.	6
2	Structural Principles in Bio-nanomaterials	Building Block of Bio-nanomaterials; Protein Nanostructures; DNA Nanostructures; Lipid Nanostructures.	12
3	Functional Principles in Bio-nanomaterials	Energy Conversion; Chemical Synthesis; Transport and Transduction.	10
4	Progress and hot Topics in Nanobiology	Design of Bio-nanomaterials; Self-assembly and Recognition; Biomolecule Motors; DNA/Protein Computing; Biosensors; Nanomedicines.	12
5	Techniques and Approaches in Nanobiology	Single Molecule Imaging: STED, STORM, PALM; Single Molecule Structure Determination: EM, X-ray diffraction;	10

		Single Molecule Manipulating: AFM, STM, OT, MT.	
total			50

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. ZOU Zhen
Prof. LI Xiang-Dong
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 entomology such as systematics, metabolism, endocrinology, reproduction, 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 I	Xiangdong Li
10	Insect Mechanical Communication II	Xiangdong Li
11	Insect Locomotor Systems /Second Exam	Xiangdong Li
12	Introduction to plant pathology	Jun Liu
13	Plant basal defense	Jun Liu
14	Plant innate immunity I	Jun Liu
15	Plant innate immunity II	Jun Liu

16	Plant epidemiology	Jun Liu
17	Disease management and plant protection/Third Exam	Jun Liu
Total		51

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 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 protein structure prediction (Associate Professor ZHANG zhuqing)

C5. Protein design 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
Section G — Electron Transport and Oxidative Phosphorylation (Professor ZHONG Liangwei)
G1. The electron transport chains
G2. Oxidative phosphorylation.

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

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	*4*

	immunity to virus	
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

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

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*	*4*

	Chapter 16. Photodetection and imaging *Chapter 17. Summary and outlook*	
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: 10 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

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	3
9	Nanowires	3
10	Carbon nanotubes	3
11	Graphene	3
12	Transition-metal dichalcogenides and Other 2D materials	3
13	Presentation skills and discussion	3
14	Presentations by students	3
15	Presentations by students	3
total		52

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

Section	Content	hours
1	**Plate tectonics and its developing history** 1. Introduction to Plate Tectonics 2. The Structure of the Earth 1) Three Layers 2) Physical Properties 3) Chemical Compositions 3. Continental Drift 1) Principal Observations 2) The Implications	12

	4. Seafloor Spreading 1) Seafloor Topography 2) Age of the Seafloor 3) Oceanic Ridge System 5. Accreting Plate Boundaries 1) Divergent Plate Boundaries 2) Convergent Plate Boundaries 3) Transform Plate Boundaries 6. Subduction 1) Distribution of Subduction zones 2) Deep Structure of the Subduction Zones 7. Continents 1) The Growth of Continents 2) Continental Margins 8. Hotspots and Mantle Plumes 1) Mantle Convection 2) Surface Volcanisms 3) Deep Origin of Mantle Plumes 9. The Wilson Cycle 1) Traditional Wilson Cycle Model 2) The Implications 10. Planetary Perspective 1) The Early History 2) Comparative Planetary	
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)	12

	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	
3	**Paleomagnetism and Plate Tectonics** 11. Introduction to Geomagnetism 1) Earth Magnetic Field 2) History 3) Study Fields 12. Basic Rock Magnetism 4) Magnetic Properties 5) Magnetic Mineralogy 6) Magnetic Domains 7) Hysteresis 8) Natural Remanent Magnetism (NRM)	12

	13. Sampling, Measurement, Analysis and Field Tests 1) Collection of Paleomagnetic Samples 2) Demagnetization Techniques 3) Display and Bedding-tilt Correction 4) Identification of Ferromagnetic Minerals 5) The Fold Test 6) Synfolding Magnetization 7) Conglomerate Test 8) Reversals Test 9) Baked Contact and Consistency Tests 10) Other Tests 14. Magnetic Reversals and Inclination Shallowing 4) Magnetic Reversals 5) Paleomagnetic Geochronlogy 6) Inclination Shallowing 15. Plate Tectonics and Sea Floor Spreading 1) Plate Tectonic Theory and Paleomagnetism 2) Sea Floor Spreading Hypothesis and Paleomagnetism 16. Paleomagnetic Poles and Paleogeographic Reconstruction 4) Procedure for Pole Determination 5) Types of Poles 6) Sampling of Geomagnetic Secular Variation 7) Paleogeographic Reconstruction 17. Regional Tectonics-Collision and Shortening 3) Evolution of the Tibetan Plateau and Tethys 4) India-Asia Collision Time and Shortening 18. Regional Tectonics-Regional Rotations 1) Rotations of the NE Tibetan Plateau 2) Rotations of the SE Tibetan Plateau 3) Rotations of the Tibetan Plateau	
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	12

	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	
5	**Plate Tectonic in Tibet Plateau** 1. Introduction of the Tibet plateau 1.1 Why is the Himalayan-Tibetan orogen so wide? 1.2 Why is the Tibetan Plateau so flat? 1.3 Why are the boundarys so steep? 1.4 Why is the Tibetan plateau just so high and no higher? 2. The process of Gondwana split and the Asian continent aggregation 2.1 The Gondwana super continent 2.2 The split of the Gondwana 2.3 The suture zones and aggregation in Tibet 3. India and Eurasia collision 3.1 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 3.2 History of research on the initial timing of Indian and Asian collision 3.3 Deformation of the northern THS in the early collisional stage 3.4 Foreland basin system 3.5 Collision patterns and suturing processes between the Indian and Asian continents	8

	4. The Raising of Tibet plateau 4.1 Index of paleoelevation 4.2 The raising of Himalaya 4.3 The raising of Tibet	
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

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

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	24

	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)	
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

Course type:

Lecture

Catalog Description:

*Climate Change 2021 spring semester is designed as an introductory course plus our research aspect in ITPCAS (Institute of Tibetan Plateau, 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 ITPCAS will introduce climate change related topics, for example, land surface heat flux retrieves 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 and so on. All of these topics will enhance our theoretical questions about climate change, especially in the Tibetan Plateau.*

The course is structured as a series of lectures and mini-seminars in which individual research cases are discussed with faculty tutors. It will cover the following topics:

Schedule of the course

Section	Content	hours
1 Prof. Yaoming Ma	**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 Prof. Yaoming Ma	**Radiation and the Earth's energy balance** 2.1 Solar and terrestrial radiation 2.2 Solar variability 2.3 Summary	4
3 Prof. Yaoming Ma	**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 Prof. Baiqing Xu	**Evidence of climate change**	4

	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	
5 Prof. Baiqing Xu	**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 Prof. Baiqing Xu	**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 Prof. Lei Wang	**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	4
8 Prof. Lei Wang	**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	4
9 Prof. Lei Wang	**Consequences of climate change** 9.1 Geological consequences	4

	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	
10 Prof. Yimin Liu	Modeling the climate 10.1 Context 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 Prof. Yimin Liu	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 Future climate projection 11.5 Modeling biases and uncertainties 11.6 Improving climate modeling over the TP 11.7 TP cold bias and Asian summer monsoon Simulation	4
12 Prof. Yimin Liu	Role of the modelling on scientific understanding I monsoon climatology 12.1 The concept of the monsoon thermal adaptation 12.2 Thermal adaptation 12.3 Impact of Land-sea distribution 12.4 Impact of Tibetan Plateau & Iranian Plateau 12.5 Thermal impacts or dynamic (isolation) impacts?	4
13 Prof. Yimin Liu	Role of the modelling on scientific understanding II monsoon variability 13.1 Biweekly oscillation of the South Asian Anticyclone 13.2 Impact of tropical cyclone on the seasonal evolution of the Asian summer monsoon 13.3 Decadal change of East Asian summer monsoon and the Tibetan Plateau impact	4
14 Prof. Lei Wang	Hydrological modelling and its applications for integrated water resources management	4
15 Prof. Baiqing Xu	Back carbon in the glacier area	4
16 Prof. Yaoming Ma	Land surface heat flux retrieve from in-situ data, remote sensing data and numerical model	4
Total		64

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

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

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

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

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

Applications of Remote Sensing on Climate Change, Land Science and Severe Weather

Instructor(s)-in-charge:

Prof. QI Youcun & Associate Prof. CAO Jie & Prof. DONG Jinwei

Course type:

Lecture

Course Schedule:

8hrs/week by instructor.

Course Assessment:

Homework: 4 assignments

Grading Policy:

Typically 20% Attendance, 40% homework, 20% Oral Presentation, 20% final.

Course Prerequisites:

Remote Sensing, Climate Change, Land Science

Catalog Description:

This course introduces the fundamentals, commonly used methods, and applications of remote sensing, and emphasizes the use of remote sensing data for studying climate change, land use change and severe weather forecasting. Climate change and land use change are the most important components of global change studies. This course would provide a comprehensive examination of land use change in the context of global environmental change, together with a practical guide for interpreting satellite imagery in severe weather situations. We will first learn the basics of remote sensing and fundamentals essential for understanding severe weather following by the remote sensing data analyses methods. Then these knowledge and tools will be used to understand the climate and land use changes as well as to improve severe weather forecasting at regional, national, and global scales. We will better understand the global change issues by examining socioeconomic drivers and physical and biological impacts of land use change and climate change.

Schedule of the course

section	content	hours	Instructor
1	**Course Introduction, Introductory Lecture** Concepts, principle	4	Youcun Qi
2	**Basic of Remote Sensing** Major Sensors for monitoring climate change Major Sensors for monitoring land use change Major Sensors for monitoring severe weather	8	Youcun Qi Jie Cao
3	**Basic of Remote Sensing** Fundamentals in Satellite imagery and severe weather, Basic information of radiances measured by satellites and its relationship with atmospheric dynamics	4	Jie Cao
4	**Methods of data processing and analyses** Remote sensing data processing Data visualization	4	Youcun Qi

5	**Methods of data processing and analyses** Land classification methods Machine learning, etc.	4	Jinwei Dong
6	**Methods of data processing and analyses** Interpreting satellite water vapor imagery Severe weather analyses	4	Jie Cao
7	**Student presentation on applications of RS**	4	Youcun Qi
8	**Remote Sensing of Climate Change** Generating the remote sensing data Rainfall detection, Snow coverage and depth detection Existing climate data and the applications Data collection and Accuracy Assessment	4	Youcun Qi
9	**Remote Sensing of Climate Change** Rainfall types and changes, Snow coverage and depth monitoring	4	Youcun Qi
10	**Remote Sensing of Land use change** Existing land use maps and the applications Land use mapping and change detection Field Data Collection (Google Earth, Field Photos, and Visual Interpretation of images). Agricultural land use change Forest changes monitoring	4	Jinwei Dong
11	**Remote Sensing of Severe weather** Water vapor imagery analysis of main ingredients of severe weather situations	4	Jie Cao
12	**Remote Sensing of Severe weather** Use of water vapor imagery for assessing numerical climate prediction model behavior and improving forecasts	4	Jie Cao
13	**Presentation of the Final project**	4	Youcun Qi Jie Cao
14	**Office hour** **Final Exam**	2 2	Youcun Qi
total		60	

Contents of the course

Section 1: Basic of Remote Sensing

1. Electromagnetic Radiation Principles
2. Elements of Visual Image Interpretation
3. Multispectral Remote Sensing Systems
4. Hyperspectral Remote Sensing Systems
5. Thermal Remote Sensing Systems
6. Active and Passive Microwave Remote Sensing

7. Basic of Remote Sensing for climate change
8. Major Sensors for monitoring climate change
9. Basic of Remote Sensing for land use change
10. Major Sensors for monitoring land use change
11. Fundamentals in Satellite imagery
12. Basic of satellite imagery in analyzing and predicting severe weather

Section 2: Methods of data processing and analyses

13. Methods of data processing and analyses
14. Data processing
15. Data visualization
16. Land classification methods
17. Machine learning, etc.
18. Interpreting satellite water vapor imagery
19. Severe weather analyses

Section 3: Remote Sensing of Climate Change

20. Generating the remote sensing data
21. Existing climate data and the applications
22. Data collection (Satellite, GPM, DPR)
23. Accuracy Assessment
24. Rainfall types and changes
25. Snow coverage and depth monitoring

Section 4: Remote Sensing of Land Use Change

26. Existing land use maps and the applications
27. Field Data Collection (Google Earth, Field Photos, and Visual Interpretation of images)
28. Land use mapping and change detection
29. Accuracy Assessment
30. Agricultural land use change
31. Forest changes monitoring

Section 5: Remote Sensing of Severe Weather

32. Interpretation of light and dark imagery features in satellite water vapor imagery
33. Potential vorticity thinking in severe weather
34. Operational use of the relationship between potential vorticity fields and water vapor imagery
35. Water vapor imagery analysis of main ingredients of severe weather situations
36. Use of water vapor imagery for assessing numerical climate prediction model behavior and improving forecasts

Textbook and any related course material:

1, John R. Jenson, 2007, Remote Sensing of the Environment: An Earth Resource Perspective

2, Christo G. Georgiev, Patrick Santurette, and Karine Maynard, 2016, Weather Analysis and Forecasting: Applying Satellite Water Vapor Imagery and Potential Vorticity Analysis, Second Edition

3, Five journal papers will be assigned for student's individual research project.
Students can find these papers from the list we provide or through the Web of Science.

Expected level of proficiency from students entering the course:
Prior to taking this course, students need to have basic GIS and imagery process skills, the final project will require quantitative problem solving skills and might entail working with small datasets.

Course title

Water Chemistry

Instructor(s)-in-charge:
Asso. Prof. Huiyu DONG, Prof. Chao LIU, & Asso. Prof. Mengkai LI
Course type:
Lecture
Course Schedule:
6hrs/week by instructor
Course Assessment:
Homework: 5 assignments
Grading Policy:
Typically 25% homework, 25% presentation, 50% final.
Course Prerequisites:
General Chemistry, Physical Chemistry
Catalog Description:
Water Chemistry is a core course in the Environmental Science and Engineering program. It provides a thorough understanding of the fundamentals of water chemistry to our incoming cohorts of students. This course details the quantitative treatment of chemical processes in aquatic systems such as lakes, oceans, rivers, estuaries, groundwaters, and wastewaters. It includes a brief review of chemical thermodynamics that is followed by discussion of acid-base, precipitation-dissolution, coordination, and reduction-oxidation reactions. Emphasis is on equilibrium calculations as a tool for understanding the variables that govern the chemical composition of aquatic systems and the fate of inorganic pollutants.
Schedule of the course

Section	Content	Hours
1	Introduction	3
2	Part 1: Review of Thermodynamics, and Setting Up and Solving Equilibrium Problems	12
3	Part 2: Acid-base Chemistry of Natural Waters	9
4	Part 3: Dissolution, Precipitation, and Complexation	9
5	Part 4: Redox Chemistry	12
6	Part 5: Chemical Kinetics	12
7	Presentation	3
Total		60

Contents of the course
Part 1: Review of Thermodynamics, and Setting Up and Solving Equilibrium Problems

37. Introduction, Review of Laws of Thermodynamics
38. Gibbs Free Energy, Chemical Potential, eq. Constants
39. Setting Up Equilibrium Problems - Tableau Method Molecular beam epitaxy
40. Solving Problems by Approximation - Log C vs. pH Diagrams

41. Temperature, Pressure, and Ionic Strength Effects on Equilibrium
42. Properties of Water, Interactions Among Solutes, Activity Coefficients
43. Activity Coefficients and Debye-Huckel Theory

Part 2: Acid-base Chemistry of Natural Waters

1. The Carbonate System and Alkalinity
2. Uses and Limitations of Alkalinity
3. Buffer Capacity

Part 3: Dissolution, Precipitation, and Complexation

4. Mineral Solubility
5. Stability Diagrams
6. Chemical Weathering and Natural Water Composition
7. Trace Metals - Inorganic Complexation

Part 4: Redox Chemistry

1. Equilibrium Calculations with Redox Reactions
2. Redox Potential (pe) as a System Variable
3. pe-pH Diagrams
4. Trace Metals - Organic Complexation
5. Effects of Complexation and Precipitation on Redox Equilibria

Part 5: Chemical Kinetics

1. Oxidation Kinetics in Homogeneous Systems
2. Heterogeneous Systems
3. Enzyme Catalysis
4. Photochemical Process

Textbook and any related course material:

Mark Benjamin, Water Chemistry, Second Edition

Stumm, Werner, and James J. Morgan. Aquatic Chemistry. New York, NY: Wiley-Interscience, 1996. ISBN: 0471511854.

Anderson, G. W. Thermodyanmics of Natural Systems. New York, NY: Wiley-Interscience, 2005. ISBN: 0521847729.

Expected level of proficiency from students entering the course:

Mathematics: strong

Chemistry: strong

Course title

Fundamental for Internet of Things and Its Applications

Instructor(s)-in-charge:
Prof. Weidong Yi
Course type:
Lecture
Course Schedule:
3hrs/week by instructor. 1 hr/week by teaching assistant.
Course Assessment:
Homework: 6 assignments
Grading Policy:
Typically 30% homework, 40% final exam, 30% final project
Course Prerequisites:
None
Catalog Description:
This course provides an introduction to the fundamental concepts and principles of internet of things (IoT)and a survey of its applications at different areas. The course is broken into four parts. In Part One, Introduction, which provides an overview of IoT applications, sensor nodes, and basic system structure,different node architectures and discusses in detail the sensing and processing subsystems as well as communication interfaces. Part Two, Basic Architectural Framework, which provides a detailed discussion of protocols and algorithms used at different network protocol layers in sensor systems. Part Three, Node and Network Management, which discusses several additional techniques and presents solutions for a variety of challenges, including power management techniques, concept of time synchronization and an overview of several synchronization strategies, a variety of localization strategies and compares their trade-offs. Security challenges and defenses against attacks on sensor networks of IoT are discussed in the part. Part Four, Applications, which provides cases study for applications in IoT, including applications for environmental monitoring , structure health monitoring, traffic control, precision agriculture, smart city , smart health-care etc.
Schedule of the course

section	content	hours
1	Motivation for an Internet of Things	8
2	Node Architecture of IoT	8
3	Operating System for IoT	8
4	Physical Layer	4
5	Medium Access Control	4
6	Network Layer	4
7	Power Management	4
8	Time Synchronization	4
9	Localization	4
10	Security	4
11	Applications	4
12	Student presentation	2

13	Final Exam	2
total		60

Contents of the course

1. Motivation for an Internet of Things
   (1) Definitions and Background
   (2) Challenges and Constrains
2. Node Architecture of IoT
   (1) The Sensing Subsystem
   (2) The Processor Subsystem
   (3) Communication Interfaces
   (4) Prototypes
3. Operating System for IoT
   (1) Functional Aspects
   (2) Nonfunctional Aspects
   (3) Prototypes
4. Physical Layer
   (1) Basic Components
   (2) Source Encoding
   (3) Channel Encoding
   (4) Modulation
5. Medium Access Control
   (1) Wireless MAC protocols
   (2) Characteristics of MAC Protocols in Sensor Network of IoT
   (3) Contention-Free MAC Protocols
   (4) Contention-Based MAC Protocols
   (5) Hybrid MAC Protocols
6. Network Layer
   (1) Routing Metrics
   (2) Flooding and Gossiping
   (3) Data-Centric Routing
   (4) On-Demand Routing
7. Power Management
   (1) Local Power Management Aspects
   (2) Dynamic Power Management
   (3) Conceptual Architecture
8. Time Synchronization
   (1) Basic of Time Synchronization
   (2) Time Synchronization Protocols
9. Localization
   (1) Ranging techniques
   (2) Range-Based Localization
   (3) Rang-Free Localization
   (4) Event-Driven Localization
10. Security

(1) Fundamentals of Networks Security
(2) Security Attacks in IoT
(3) Protocols and Mechanisms for Security

11. Applications

Textbook and any related course material:

1. Waltenegus Dargie and Christian Poellabauer, *Fundamentals of Wireless Sensor Networks*, 2010, John Wiley& Sons Ltd
2. Course Reader (Selected Reference Papers)

Expected level of proficiency from students entering the course:

None

Course title:

Biodiversity science

Instructor(s)-in-charge:

Prof. MA Keping

Course type:

Lecture

Course Schedule:

4hrs/week by instructor

Course Assessment:

Homework: 10 assignments

Grading Policy:

Typically 40% homework, 60% final.

Course Prerequisites:

Ecology, General biology, Biogeography

Catalog Description:

This course includes 14 sections:

1. Introduction
   a) history of biodiversity science, conservation ecology and conservation biology
   b) hot topics for biodiversity science
2. Biodiversity status and conservation strategies
3. Biodiversity distribution pattern and associated environmental factors
4. Species distribution model and its applications
5. Biodiversity maintenance mechanisms
6. Biodiversity and ecosystem function and services
7. Biodiversity monitoring and community assembly
8. Biodiversity informatics and big data science
9. Indicators and surrogates for biodiversity
10. Climate and biodiversity
11. Biodiversity mapping and conservation priority areas
12. Biodiversity hotspots and conservation planning
13. On site and off site conservation
14. Global efforts in biodiversity conservation

Schedule of the course

section	content	hours
1	Introduction ● history of biodiversity science, conservation ecology and conservation biology ● hot topics for biodiversity science	3
2	Biodiversity status and conservation strategies	3
3	Biodiversity distribution pattern and associated environmental factors	3
4	Species distribution model and its applications	4

5	Biodiversity maintenance mechanisms	4
6	Biodiversity and ecosystem function and services	4
7	Biodiversity monitoring and community assembly	4
8	Biodiversity informatics and big data science/ Student presentation	4
9	Biodiversity mapping and conservation priority areas	4
10	Indicators and surrogates for biodiversity	4
11	Climate and biodiversity	4
12	Biodiversity hotspots and conservation planning/ On site and off site conservation	4
13	Global efforts in biodiversity conservation/ Student presentation	4
14	Final exam	3
total		52

Contents of the course

1 Introduction

1) History of biodiversity science, conservation ecology and conservation biology
2) Hot topics for biodiversity science
3) Global significance of biodiversity research in China
4) Introduction of journals related to biodiversity science

2 Biodiversity status and conservation strategies

1) What is biodiversity
2) Status of biodiversity
3) Vegetation geographical distribution
4) Endemism of biodiversity
5) Threats to biodiversity
6) Assessment of threatened status of biodiversity
7) Conservation progress

3 Biodiversity distribution pattern and associated environmental factors

1) Brief history and current knowledge about geographical patterns in biodiversity
2) Ecological hypotheses explaining biodiversity patterns
3) Evolutionary hypotheses explaining biodiversity patterns
4) Stochastic processes on biodiversity patterns
5) Effects of spatial scales on biodiversity patterns
6) Exercise: the estimation of biodiversity patterns

4 Species distribution models and its applications

1) Determinants of species distributions
2) How species distribution models work?

3) Validation of species distribution models
4) Assumptions of species distribution models
5) Uncertainties in the calibration of species distribution models
6) Application of species distribution models

5 Biodiversity maintenance mechanisms

1) Deterministic processes, including competitive exclusion, environmental filtering, Janzen-Connell hypothesis, and species pool hypothesis
2) Stochastic processes, including neutral theory, dispersal limitation
3) Methods for the test of different hypotheses
4) Exercise: Using null models to test the mechanisms of species assembly

6 Biodiversity and ecosystem function and services

1) Brief history of the topic
2) Major concepts in studies on biodiversity and ecosystem function and services
3) Relationships between biodiversity and ecosystem function and services
4) Mechanisms of biodiversity effects
5) Methods for the testing of biodiversity effects
6) Major biodiversity experiments

7 Biodiversity monitoring and community assembly

1) Brief history of the topic
2) Major initiatives for biodiversity monitoring
3) Biodiversity monitoring in China
4) Species coexistence and Community assembly rules

8. Biodiversity informatics and big data science

1) Brief history of the topic
2) Major initiatives for biodiversity informatics
3) Biodiversity informatics in China
4) Big biodiversity data resources
5) Mapping data based research

9. Indicators and surrogates for biodiversity

1) Surrogates, umbrellas and keystones
2) Indicators for biodiversity loss
3) Tradeoffs between different priorities and species
4) Holistic indicators of biodiversity

10. Climate and biodiversity

1) Species ecophysiology and environment
2) Migratory species and changing needs
3) Climate change-what does it mean on a species level
4) Phenology, asynchrony, mis-matches and novel communities
5) Microclimate and different forms of adaptation

11. Biodiversity mapping and conservation priority areas
    1) Metrics in biodiversity
    2) Scale and types of resolution in biodiversity and what they mean
    3) Rarity, threat, choosing units for biodiversity analysis and the implications
    4) Mapping biodiversity threats
    5) Understanding biodiversity data, assumptions of analysis, types of data
    6) Biodiversity models, types and applications
    7) Homework: Redlist of ecosystems assessment
12. Biodiversity hotspots and conservation planning
    1) Asking questions with biodiversity data
    2) Understanding assumptions in biodiversity analyses
    3) Mapping hotspots
    4) Tradeoffs in prioritization approaches
    5) Approaches for developing priorities
    6) Landscape scale conservation planning and tools available
    7) Homework: Continue and finish redlisting ecosystem
13. On site and off site conservation
    1) Discussion of redlist of ecosystems, how do priorities compare, is the data there
    2) Species vs ecosystem approaches to conservation
    3) Translocation, breeding
    4) Weighing approaches and case-studies in different approaches to conservation and their uses: how to balance priorities and costs
    5) Homework: Each student will be assigned a species to develop conservation plans for under different circumstances
14. Global efforts in biodiversity conservation
    1) Discuss case-studies, include real examples of where these approaches have been used, explore tradeoffs between different approaches, discuss success
    2) Conservation at different scales
    3) Conservation targets
    4) International bodies and conservation, CBD and other multilateral agreements

Textbook and any related course material:

Navjot S. Sodhi and Paul R. Ehrlich. 2010. Conservation Biology for All. Oxford University Press;

Richard J. Ladle and Robert J. Whittaker. 2011.Conservation Biogeography. Wiley-Blackwell

Richard Primack. 2014. Essentials of Conservation Biology. Sinauer Associates

Mark V. Lomolino, Brett R. Riddle, Robert J. Whittaker, James H. Brown. 2010. Biogeography. Oxford University Press

Fred Van Dyke. 2020. Conservation Biology: Foundations, Concepts, Applications. Springer

Expected level of proficiency from students entering the course:

General biology: moderate
Ecology: moderate
Biogeography: moderate

Course title

Development Geography

Instructor(s)-in-charge:

Prof. DENG Xiangzheng & Prof. DONG Jinwei & Associate Prof. SONG Wei & Associate Prof. WU Feng

Course type:

Lecture

Course Schedule:

3hrs/week by instructor

Course Assessment:

Homework: 4 assignments；student presentation

Grading Policy:

Typically 30% homework, 30% student presentation, 40% final.

Course Prerequisites:

NULL

Catalog Description:

Development geography is a subdiscipline of geography that studies human development and quality of life. Based on geography, development geography integrates disciplines such as management, economics, ecology, etc., and has the characteristics of integrity and interdisciplinary. Development Geography facilitates a more integrated understanding of development and places development problems within the context of the global economy and society. Its topics cover the concepts, theories and approaches, and development trend etc., which ranges from population and culture to agricultural and industrial development. Specifically, the contents of the courses include the concepts and progress of development geography, overview of geographical development differences; and specific analysis of geographical distribution and differences in income inequality and poverty, population, education and health, culture, resource and environment carrying capacity, rural and agricultural development, urban and industrial development, and the regional differences of globalization and international and regional development, etc. Further, case studies will be presented to highlight the possible solutions, as well as the problems, at local, national and international levels.

Schedule of the course

Section	Content	Hours
1	Concepts and progress of development geography	3
2	Overview of development geography	3
3	Overview of geographical differences in regional development geography	6
4	Income inequality and poverty	3
5	Geographical distribution of population in China	3
6	Land use policy and management in China	3
7	Agriculture and food security in	3

	China	
8	Student presentation and discussions	3
9	Resource and environmental carrying capacity and regional differences	6
10	Geographic development differences in rural areas and agriculture	3
11	Geographic development differences in cities and industry	3
12	Student presentation and discussions	3
13	Review on globalization and regionalization development	3
14	International trade, cooperation and regional development	3
15	The balance of payments, financial stability and regional development	3
16	The national cases: China, Brazil and India	3
17	Student presentation and discussions	3
18	Exam	3
Total		60

Contents of the course

Section 1: Understanding Development Geography

44. Concepts and progress of development geography
    (8) Concepts, discipline classification and development of geography
    (9) Overview of geographical research and development
    (10) Concepts relating to geography
    (11) Tools applied in geography
45. Overview of development geography
    (1) Concepts and research objects of development geography
    (2) Role of development geography in geography
    (3) Theories in development geography
    (4) Theoretical and practical significance of development geography
    (5) Research prospects in development geography
46. Overview of geographical differences in regional development geography
    (1) Indicators for geographic regional development differences measure
    (2) Geographic regional development differences in China
    (3) Development differences between developing and developed countries
    (4) Reasons for regional development difference and the theoretical origins

Section 2: Social and Economic Development

47. Income inequality and poverty
    (1) Fundamentals of income inequality and poverty
    (2) Measurement and representation of income inequality
    (3) Measurement and representation of poverty
    (4) Policies to address income inequality and poverty

48. Geographical distribution of population in China
    (1) Characteristics of population growth
    (2) Characteristics of population structure
    (3) Spatial and geographical distribution of population
    (4) Population growth and migration policy
49. Land use policy and management in China
    (1) Evolution of land use policies in China
    (2) Effectiveness and impacts of major land use policies in China
    (3) Discussion on land system reform
50. Agriculture and food security in China
    (1) Role of agriculture and food security
    (2) Spatial distribution of agricultural production and regional difference
    (3) Reform of agricultural policies

Section 3: Environmental and Rural-Urban Development

51. Resource and environmental carrying capacity and regional differences
    (1) The effect of environmental protection and ecological civilization construction on geographical development
    (2) Measurement and characterization of environmental capacity and resources and environmental carrying capacity
    (3) Measurement and characterization of ecological development efficiency
    (4) Research on the convergence of regional economic development
    (5) Ecological civilization construction and sustainable development strategic spatial layout
    (6) Transformation path and policy choices in underdeveloped areas
52. Geographic development differences in rural areas and agriculture
    (1) The role of cities and industry in geographic development
    (2) Urbanization process and spatial distribution differences
    (3) Industrial development status and spatial distribution differences
    (4) Urbanization development and industrial reform policies
53. Geographic development differences in cities and industry
    (1) The role of cities and industry in geographic development
    (2) Urbanization process and spatial distribution differences
    (3) Industrial development status and spatial distribution differences
    (4) Urbanization development and industrial reform policies

Section 4: Globalization, trade and regional development

54. Review on globalization and regionalization development
    (1) Role of globalization on geography development
    (2) Current international geographical differences
    (3) Status of China in the globalization process
    (4) Policy choice of developing countries in the process of globalization
55. International trade, cooperation and regional development
    (1) Theory of international trade for the development of the geographical environment
    (2) International cooperation organizations and institutions
    (3) Geopolitics and protectionism

(4) Trade policy comparison between countries

56. The balance of payments, financial stability and regional development
    (1) International financial stability for the role of regional development
    (2) Balance of payments deficit and trade war
    (3) Effects of the global financial crisis on developing countries
    (4) Financial system reform and promoting the development of regional policy
57. The national cases: China, Brazil and India
    (1) National development in the future
    (2) China's development present situation and the future
    (3) Brazil's development present situation and the future
    (4) India's development present situation and the future

Textbook and any related course material:

Hodder, R. (2000). Development Geography. Psychology Press.
Potter, R., Conway, D., Evans, R., & Lloyd-Evans, S. (2012). Key Concepts in Development Geography. Sage Publications.
Lawson, V. (2014). Making Development Geography. Routledge.

Expected level of proficiency from students entering the course:

Geography: Medium
Economics: Primary

Course title

Integrative Systematic Biology

Instructor(s)-in-charge:

Prof. ZHU Chao-Dong, Dr. LUO A-Rong, Dr. Douglas CHESTERS

Course type:

Lecture

Course Schedule:

4hrs/week by instructor.

Course Assessment:

Homework: 12 assignments

Grading Policy:

Typically 40% homework, 40% each midterm, 20% final.

Course Prerequisites:

Basic knowledge in general biology and molecular biology.

Catalog Description:

This course offers an introduction to Integrative Systematic Biology, generally including four sections. The first section covers topics aiming at the foundation of systematic biology – species classification, such as traditional morphological taxonomy, morphometrics, graphic analysis, and molecular species delimitation. The second section then targets the systematics of classified species via both molecular sequences and morphological characters. With this section, students will be knowledgeable of molecular models accounting for molecular evolution, advances in phylogenomic research, methods for estimating evolutionary timescales of the Tree of Life, and so on. The third section focuses on advanced topics including ancestral trait reconstruction, species diversify and diversification rates, co-evolution between species groups, evolutionary hypotheses, and so on. The fourth section provides demos which would teach students important techniques in this field, such as R programming, statistics analyses, and tree reconstruction.

Schedule of the course

Section	Content	hours	Lecturer
1	Systematics foundations	3	CDZ
2	Molecular Systematics	3	CDZ
3	Integrative Systematics	3	CDZ
4	Models and Methods in Systematics	3	ARL
5	Phylogenomics (2 hrs) Demo session: Sequence Analysis Pipeline (1 hr)	3	ARL
6	Student Presentation	3	DC
7	Molecular Ecology	3	DC
8	Applied DNA Barcoding	3	DC
09	Phylogeography and Conservation	3	MCO,DC
10	Demo Session; Phylogenetic Community Ecology	3	DC
11	Student Presentation	3	DC, MCO
12	Case Studies across the Tree of Life	3	MCO
13	Molecular Clock and Timescale of the	3	ARL

	Tree of Life		
14	BEAST	3	ARL
15	Integrative Insect Phylogenetics	3	CDZ
16	Lab Tour	3	ARL
17	Exam	3	CDZ
Total		51	

Contents of the course

Section 1: Foundations of systematic biology

58. Systematics
59. DNA sequence data in systematics
    (12) History and principles of molecular systematics
    (13) Methods; distance, parsimony, maximum likelihood, Bayesian inference; phylogenetics software
60. Phylogenomics
    (1) Advances in sequencing technology
    (2) Principles of orthology, marker choice, processing pipelines

Section 2: Applied molecular sequence analysis

61. DNA barcoding and molecular ecology
    (1) History of DNA taxonomy, barcoding, integrative taxonomy
    (2) Applied DNA barcoding for plant and animal ecology
    (3) Phylogeography and conservation

Section 3: Case studies in integrative systematics

62. Case studies across the tree of life; from Archaea to the great apes, case studies will be presented to highlight the importance of systematics and integrative methodologies
63. Applications of systematics; timescales of the tree of life
64. Insects phylogenetics, diversification and key innovations (flight, metamorphosis, etc.); Pancrustacea; the Strepsiptera problem;

Textbook and any related course material:

David M. Hillis. 1996. Molecular Systematics.
Nathan G. Swenson. 2014. Functional and Phylogenetic Ecology in R.

Expected level of proficiency from students entering the course:

Biology: strong
Mathematics: competent

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*