COURSE CATALOG

2022-2023 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 courses online. Because the capacity of every course is limited and first come first select, this system will be opened during Jan. 7th –Feb. 7th , 2023 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.7-Feb. 7	Register courses in Course Selection System
Feb.27	Courses start
Feb.27-Mar.10	Confirm the registration with assistant teacher of each course
June. 30	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.

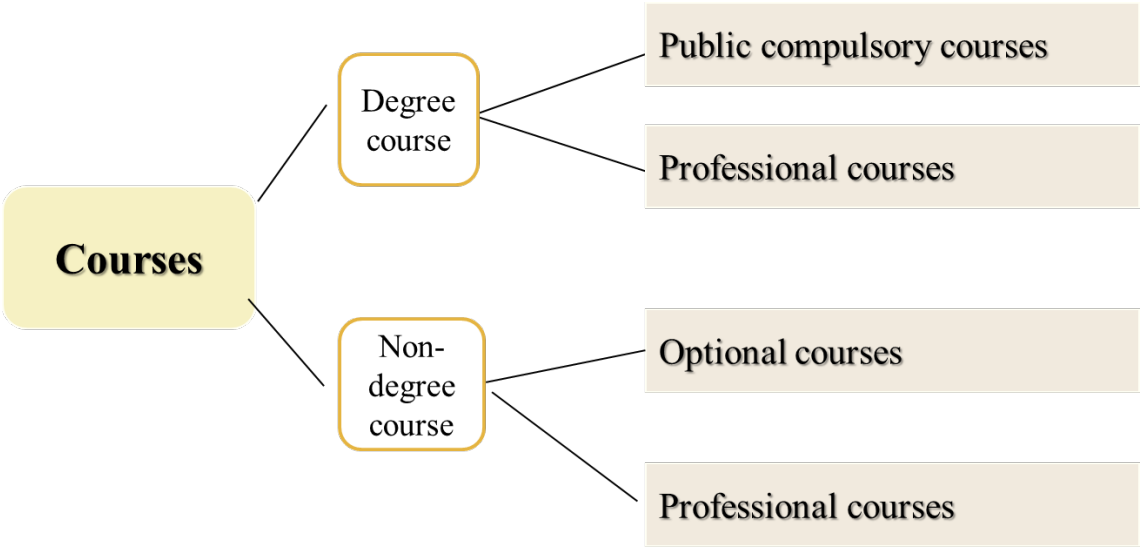
4. General Degree Requirements for MD-PhD Students

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 1 (2 credits);
(2) Elementary Chinese 2 (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. Yangjing (yangjing7@ucas.ac.cn) before the February 28th.

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: 010-82689050, Ms. Sophie
- E-mail: hutian@ucas.ac.cn

Education Coordinator for Public courses:

- Phone: 010-69671192, Ms. Yangjing
- E-mail: yangjing7@ucas.ac.cn

Class No.	Code	Name	Hours	Credits	Professors	Weeks	Date&Time	First Class	VooV Meeting ID	Assistant teacher
Y-1	050102DGB002H-1	Elementary Chinese1、2	128/128	2	LIU Xiaomeng	2nd-17th	Mon.(8:30-12:10) Tue. (8:30-12:10) Thur.(8:30-12:10) Fri. (8:30-12:10)	Feb.27th	487-4384-7340 744-3088-4831	joe06082000@163.com
X-1	050102DGB001H-1	China Panorama	48	2	Cao Zhihong	2nd-17th	Tue.13:30-16:20	Feb.28th	447-2474-7670 PW: 2023	244091995@qq.com
A-1	120500MGB011H-1	Academic Morality and Writing Norms	20	1	YE Qing	2nd-8th	Mon.19:00-21:50	Feb.27th	449-8831-8978	changsichen21@mails.ac.cn
Optional courses	050200DGX001H-1	Academic Communication for International Conferences	40	1	YU Hua	2nd-16th	Mon.13:30-16:10	Feb.27th	713-6333-6994 PW: 0901	zhouyingkun15@mails.ucas.ac.cn

Code	Name	Type	Hours	Credits	Professor in charge	Weeks	Date&Time	First Class Date	VooV Meeting	Assistant teacher's email
0703I0D01002H	Nanotechnology for Solar Energy Utilization	Professional Courses	50	3	HE Tao	2nd-18th	Thur.(13:30-16:20)	2-Mar	ID:87270551844;PW:202300	gongy2019@nanoctr.cn
0703I0D01003H	Nano Electronic Materials	Professional Courses	52	3	XIE Liming	2nd-18th	Wed.(13:30-16:20)	1-Mar	ID:50887815325; PW:666666	wujuanxia@nanoctr.cn
0705I0D01001H	Physical Geography	Professional Courses	60	4	FANG Xiaomin	2nd-16th	Tues.(13:30-16:20)	28-Feb	ID:78436539105;PW:1234	kangjian@itpcas.ac.cn

0705I0D01007H	Applications of Remote Sensing on Climate Change, Land Science and Severe Weather	Professional Courses	60	4	QI Youcun	2nd-18th	Mon. (19:00-21:50)	27-Feb	ID:39882192107;PW:123321	lidh@igsnrr.ac.cn
0706I0D01001H	Climate Change	Professional Courses	64	4	MA Yaoming	2nd-17th	Mon.(8:30-11:20); Sat.(8:30-11:20)-from 29 Apr.-10 Jun	27-Feb	ID:31137551557;ID from 29 Apr:34494696564	wqma@itpcas.ac.cn
0709I0D01001H	Plate Tectonics and Evolution of Tibetan Plateau	Professional Courses	75	5	DING Lin	2nd-14th	Wed.(8:30-11:20); Fri.(8:30-11:20)	1-Mar	Wed-ID:69344613335;Fri-ID:49161149065	flcai@itpcas.ac.cn
0710I0D01006H	Nano-biology	Professional Courses	50	3	CHEN Deliang	2nd-18th	Wed.(09:20-12:10)	1-Mar	ID:69968183408;PW:9197	lantongchun21@mails.ucas.ac.cn
0710I0D01008H	Molecular Entomology and Plant Pathology	Professional Courses	51	3	LI Xiaodong	2nd-18th	Tues (13:30-16:20)	28-Feb	ID:64786525965; PW:123123	jiangh@ioz.ac.cn
0710I0D01009H	Biochemistry	Professional Courses	60	4	ZHONG Liangwei	2nd-19th	Tues (09:20-12:10); Thurs (09:20-12:10) only on 2-Mar and 30-Jun .	28-Feb	ID:95026595595;PW:001122	2246163798@qq.com
0710I0D01010H	Introduction to Epigenetics and RNA Silencing	Professional Courses	60	4	ZHANG Xiaoming	2nd-16th	Thur.(13:30-16:20)	2-Mar	ID:99133572088	liqi@ioz.ac.cn
0710I0D01011H	Nanobiological Sensing and Detection	Professional Courses	60	4	LI Lele	2nd-16th	Wed.(13:30-16:20); Fri.(18:10-21:00, 14-Apr, 21-Apr, 28-Apr, 5-May and 12-May)	1-Mar	Wed-ID:88650537007;PW:1234;Fri-ID:75881619007;PW:1234	zhaojian@nanoctr.cn

0710I0D01013H	Conservation Biology	Professional Courses	60	4	JIANG Zhigang	2nd-16th	Wed.(19:00-21:50)	1-Mar	ID:38767752761	evansowuor4@gmail.com
0710I0D01014H	Biodiversity Science	Professional Courses	50	3	MA Keping	2nd-17th	Mon.(13:30-16:20)	27-Feb	ID:74533243360;PW:5647	niuhs@ucas.ac.cn
0710I0D01015H	Integrative Systematic Biology	Professional Courses	51	3	ZHU Chaodong	2nd-17th	Thur.(19:00-21:50)	2-Mar	ID:903-4883-6215; PW: 123456	zhouqingsong@ioz.ac.cn
0713I0D01001H	Plant Physiology and Ecology	Professional Courses	51	3	QU Laiye	2nd-18th	Fri.(13:30-16:20)	2-Mar	ID:63496941617	yangyao_st@rcees.ac.cn
0713I0D01002H	Global Change Ecology	Professional Courses	60	4	WANG Tao	2nd-12th	Tue.(13:30-16:20); Fri.(13:30-16:20)	28-Feb	Tue-ID:57661419354; Fri-ID: 76891292910	liu.dan@itpcas.ac.cn
0812I0D01003H	Fundamental for Internet of Things and Its Applications	Professional Courses	50	3	YI Weidong	2nd-18th	Mon.(18:10-21:00)	27-Feb	ID:529169785	xieshijun19@mails.ucas.ac.cn
0817I0D01001H	Chemical Reaction Engineering	Professional Courses	60	4	LI Chunshan	2nd-16th	Thur.(18:10-21:00)	2-Mar	ID:89164833170;PW:2023	yxia@ipe.ac.cn
0817I0D01002H	Green Chemical Engineering	Professional Courses	60	4	ZHANG Guangjin	2nd-16th	Wed.(13:30-16:20)	1-Mar	ID:84115941673	zengshi2020@126.com
0817I0D01003H	Energy Chemistry and chemical engineering	Professional Courses	60	4	LI Songgeng	2nd-11th	Mon.(13:30-16:20); Fri.(18:10-21:00)	27-Feb	Mon-ID:55813577031;PW:2023; Fri-ID:87437265084;PW:2023	haorongjiang18@mails.ucas.ac.cn
0817I0D01005H	Fluidization Engineering and Multiphase Flow	Professional Courses	60	4	WANG Wei	2nd-16th	Wed.(18:10-21:00)	1-Mar	ID:82577799920;PW:136159	zhangxuekuan@ipe.ac.cn

2022－2023 学年春季和夏季学期校历

年度 year	2023 春季学期 (Spring Semester)																2023 夏季学期 (Summer Semester)			
月份 month	二月 (Feb)	三月(Mar)					四月(Apr)			五月(May)					六月(Jun)		六月 (Jun)			七月 (Jul)
周次 week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	I (17)	II (18)	III (19)	IV (20)
星期一（Mon）	20	27	6	13	20	27	3	10	17	24	1 劳动	8	15	22	29	5	12	19	26	3
星期二（Tue）	21	28	7	14	21	28	4	11	18	25	2	9	16	23	30	6	13	20	27	4
星期三（Wed）	22	1	8	15	22	29	5 清	12	19	26	3	10	17	24	31	7	14	21	28	5
星期四（Thu）	23	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22 端午节	29	6
星期五（Fri）	24	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30	7
星期六（Sat）	25	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8
星期日（Sun）	26	5	12	19	26	2	9	16	23	30	7	14	21	28	4	11	18	25	2	9

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 book).

Course Prerequisites:

None.

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

	Chapters	Sections	hours
1	Introduction to Nanobiology	Scope and Objects of Nanobiology; Historical Development of Nanobiology; The Unfamiliar World of Nanobiology: Its Unique Properties;	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	Information-Driven Nano-assembly; Bioenergetics; Chemical Transformation; Nano-transport;	10
4	Frontier Topics in Nanobiology	Protein Design; Motor Nanodevice; Bio-nanocomputers; Bio-nanosensors;	12
5	Techniques and Approaches in Nanobiology	Nano-Imaging: STED, STORM, PALM; Nano-Manipulating: AFM, STM, OT, MT; Single Molecule Structure Determination: EM,	10

		X-ray diffraction;	
total			50

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 Schedule:

3hrs/week by instructor.
Tuesday afternoons, from 13:30-16:20.

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 digestion system	Xiangdong Li
7	Insect locomotion systems	Xiangdong Li
8	Insect nervous systems	Xiangdong Li
9	Insect visual signaling	Xiangdong Li
10	Insect chemical communication	Xiangdong Li
11	Insect mechanical communication /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 Professor ZHANG Zhuqing)
- C1. Protein synthesis
- C2. Protein targeting
- C3. Protein modifications
- C4. Protein folding and protein structure prediction (Professor ZHANG Zhuqing)
- C5. Protein design and structure-based drug design (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, Sixth edition.
- ✧ Courseware updated in 2023.
- ✧ Research papers.
- ✧ 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, classroom exercise, student presentations

Course Schedule:

4 hrs/week：3 hr. lecture by the instructors, one hr. Offline Pre-recorded Reading Course. "Inverted Classroom" : Student presentation session will be held after the main course presentations.

*19:00-21:50. Wednesday, offline reading section 1 hr., (**Starts form the March, 1 2023, every Wednesday until June 5, 2023**).*

Course Assessment:

Homework: 3 assignments

Grading Policy:

40% reading course, 60% final exam + class attendance.

Course Prerequisites:

University level education in Biology, Biological Technology or applied biology sciences like Agricultural Science, Forestry Science, Environmental Science, Aquatic and Oceanic Sciences, Medical and Veterinary Science as well as in university level education in Education Science and Management Science.

Catalog Description:

Conservation Biology is a science of protecting biodiversity, preventing human caused species extinctions and maintaining sustainable development and well-being of human society. Conservation Biology was established in mid-1990s in the United States of America, and it has fully grown into a main stream science since its' born. In this course, the professor will start with the lecture, The Pandora's Box: Zoonosis and Conservation, to illustrate the emerging and reemerging of pandemic disease, particularly zoonosis- the wild animal human share disease and its impacts on human society, taking the outbreak of COVID-19 as an example to shed lights on the new challenge in Conservation Biology. Then the instructor will give a briefly review of human civilization, followed by introducing the new concepts such as public goods and services, Veblon Effect, consumerism, and consumer behavior in modern society from behavioral economics perspective, animal welfare and animal rights from philosophy perspective and the professor will emphasize the needs of rethinking about the doctrines in the master piece of philosophy, Tao Te Ching, and social norms. Then the professor will talk about the history, scope and missions as well as theoretic frames and practice measures of Conservation Biology. In the following lectures, the professor will present the principles, methods and characteristics of Conservation Biology, which now is transforming into a new science—Conservation Sciences. Dr. Liu will give an introduction to experimental design and data analyses in conservation with computer practice in the classroom. Species diversity is the core of biodiversity. The professor will introduce the concept of species in evolution, the famous question in science: "How many species are there on Earth?", plus the Tree of Life. Then the professor will elaborate on the speciation and extinction of species and the last effort of reviving an extinct species—the de-extinction protocol.

Global Change is an important issue and it is also a disputing issue. The professor will trace the issue and talk about its impacts on conservation with examples form the Qinghai-Tibetan Plateau and the Arctic. Plausible mitigation measures of the impacts of global change, like zero carbon release, carbon emission trade, will be given. The

professor will outline the mega biodiversity countries, biodiversity hot spots, global vs. China's biomes. The professor will also introduce the diverse landscapes, the sharply contrasting climate types, different habitats and rich fauna and flora in the country. A piece of BBC Wild China will be played in the classroom to aid the students to understand the fauna and flora in the country. Dr. Liu will talk about the conservation of primates with stories of social behavior of the Sichuan snub-nosed monkey. 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 the legend of giant panda as an example of flagship species and talk about the down-listing of giant panda in China's Red List of Biodiversity in 2016, at same time introduce the IUCN Red List Criteria for Endangered Species and China's Red List of 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 law 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. Small population is a real problem in conservation, with practice in computer simulation, the students will understand the genetic problems in small populations. The professor with talk about Extinction Vortex, the genetic draft, the genetic purge and the Population Variability Analyses (PVA) in the introduction to conservation Genetics. Agricultural diversity is a key to human well-being, the professor will talk about the animal domestication in nascent human civilization, the Green Revolution and the crisis in crop and domestic animal breeds in modern society. In situ *and* ex situ *conservation are two major approaches in preserving threatened species. 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 from China. The professor will introduce the translocation of endangered species and reintroduction of locally extinct species. The professor will also introduce the protected areas (PAs) in terms of the IUCN definition such as, natural reserves, wildlife refuge, national parks, and nature parks, World Natural Heritage Sites, as well as the "Green for Grain", "Green for Grass" projects and Ecological Civilization perspective in China as examples of in situ conservation, and will review the "Half Earth" initiative and the development and analyze the achievements and shortfalls in management of PAs.*
According to the new requirement of the UCAS in 2020, the professors are required to add contents about the scientific reading to improve the reading comprehensive ability of the students of the course. Reading Skills for Students in Conservation Science will be indispensable part to the course, please consult **Course Contents and Schedule** *for details of the Reading Skills for Students in Conservation Science.*

"Inverted Classroom". The part of the student oral presentations in the course lectures serve as "Inverted Classroom". Such a practice is a rearrangement of lectures to student presentations, shifting the power of learning to students. Each student in the course will have time to focus more on proactive project-based learning, working together to address localization or globalization challenges and other real-world issues to understand conservation. The classroom is thus inverted that requires students to work independently before the presentations, to access materials in library, to read enhanced e-books, to search for reference and to discuss with other students on the Internet. The professor and Teaching Assistant will guide the student presentation and will lead corresponding discussion in the inverted classroom. The professor and Teaching Assistant will communicate with everyone in the classroom through Internet. In the Inverted Classroom, students independently work out plan for learning and presentation of knowledge, while the professor and Teaching Assistant will adopt teaching and collaboration methods to meet the needs of students and facilitate their personalized learning and presentation. The goal of student presentation in Inverted Classroom is to let students learn more real know-how from their thesis and future career through practice.

Course Contents and Schedule

Lecture*	Contents
1	1） The Pandora's Box: Zoonosis and Conservation (Prof. Jiang) 2） Offline Reading in Conservation 1: Introduction (Prof. Jiang)
2	1) History of Conservation (Prof. Jiang) 2) Offline Reading in Conservation 2: Reading through the Internet (Prof. Jiang)
3	1) Principles, Ideas and Methods (Prof. Jiang) 2) Offline Reading in Conservation 3: Comprehensive Reading (Prof. Jiang)
4	1) Speciation, Extinction and De-Extinction (Prof. Jiang) 2) Offline Reading in Conservation 4: Speed reading (Prof. Jiang)
5	1) Biodiversity in Agriculture and Biodiversity in China (Prof. Jiang) 2) Offline Reading in Conservation 5: Critical Reading (Prof. Jiang)
6	1) Introduction to Conservation Genetics (Prof. Jiang) 2) Offline Reading in Conservation 6: Intensive Reading (Prof. Jiang)
7	1) Ex situ conservation (Prof. Jiang) 2) Offline Reading in Conservation 7: Reference Management (Prof. Jiang)
8	1) Criteria for Endangered Species and IUCN Red lists (Prof. Jiang) 2) Offline Reading in Conservation 8: Summarizing and Reviewing (Prof. Jiang)

9	1) Protected Areas 2) Offline Reading in Conservation 9: Learning Writing from Reading (Prof. Jiang)
10	1) Global change and its impacts on conservation 2) Offline Reading in Conservation 10: Learn to Review Manuscripts (Prof. Jiang)
11	1) Introduction to Experimental Design and Data Analyses in Conservation (Prof. Liu) 2) Offline Reading in Conservation 11: Presenting What You Read (Prof. Jiang)
12	1) Status, Behavior and Conservation of Primates (Prof. Liu) 2) Offline Reading in Conservation 12: Preparing for Your Future (Prof. Jiang)
13	*"Inverted Classroom"*： Student Presentation I (Prof. Jiang) Offline Reading in Conservation 13: From reviews to action plans (Prof. Jiang).
14	*"Inverted Classroom"*： Student Presentation II (Prof. Jiang) Offline Reading in Conservation 14: The Review Chapter and Thesis Format (Prof. Jiang)
15	Examination Offline Reading in Conservation 15: Looking for grants and jobs to realize your dreams (Prof. Jiang)

Contents of the course：

Lecture 1: The Pandora's Box: Zoonosis and Conservation

(1) The outbreak of COVID--19 in 2019
(2) The diseases and zoonosis
(3) The Black Death
(4) The remerging and newly emerging diseases
(5) Who opens the Pandora Box?
(6) Infectious disease and wildlife populations
(7) MERS, SARS, COVID-19, lessons so far for conservation…

Lecture 2: 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 3 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 4 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 5 Speciation, Extinction and De-Extinction

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

Lecture 6 Global Change and its Impacts on Conservation

(1) Global change: what is happening now?
(2) The evidence and arguments
(3) Why the dispute?
(4) Impacts of global change on conservation

Lecture 7 Diversity in Agriculture and 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) Crop and domestic animal diversity in agriculture
(8) Crops, fruits and garden plants native to the far east
(9) Animal domestication

Lecture 8: The Small Population Problem in Conservation

(1) The small population problem
(2) The Extinction Vortex
(3) The inbreeding
(4) The genetic draft
(5) The genetic purge
(6) The Population Variability Analyses (PVA)
(7) The classroom practice Web PopGen® simulation

Lecture 9: 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 10: 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 11: 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) Reintroduction of Saiga in China
(5) Behavioral problems in captive bred animals
(6) A synthesis: Captive Breeding of Giant Panda
(7) *Ex situ* conservation of plants: Germplasm resource repository and botanical gardens
(8) Artificial propagation of *Drebremium*

Lecture 12: 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 land we can set aside?

Lecture 13: Student presentation I

Lecture 14: Student presentation II

The final mark of the student will be 20% attendance and 40% the presentation of the reading exercise + 40% final exam. The final exam will be an open-class exam.

Offline Reading Skills for Students in Conservation Science

The outlines

The plan to give the *Reading Skills for Students in Conservation Science* in the course of *Conservation Biology* is introduced below. Each part of the following 8 parts will be given at the fourth lecture hour of each lecture. Students will give their presentation about literature reading choosing one of the three topics listed below. The presentations of students will be arranged into 2 lecture sections, we have slots for all students registered so far, if more students take the course, we will extend the student presentation section.

Part I General introduction

I.I Why?

- Knowledge building/Learning
- Master the skill of critical reading
- The needs of self-taught

I.II How?

- Comprehensive reading
- Intensive reading
- Critical reading

I.III What?

- Scientific literature
- Science media
- Popular science

Part II Reading through the Internet

- The Knowledge Explosion
- The Internet Revolution
- A convenient, efficient and prevalent way
- Knowledge mining from the internet

Part III Comprehensive reading
- For academic learning
- For general interests
- For leisure (time-killing)

Part IV Fast reading
- How get the main ideas of what you read?
- The abstracts and summaries
- The tables and figures
- The topic sentences
- Building your vocabulary

Part V Intensive reading
- Learning the methodology
- Master the new advances
- Discover new direction for study

Part VI Critical reading
- Learn to ask questions
- Learn to be critic
- Find out the key points from a paper or a book

Part VII Learn to review or to comment on manuscripts
- What is the aim of the manuscript?
- Is the problem worth of study?
- What is the question/working hypothesis/the goal in the study?
- How did the authors test the hypothesis or achieve the goal stated?
- What did the authors find?
- Did author(s) discuss the implication and problems associated with the study?
- Is the author(s) read the current relevant literature for the study?

Part VIII Taking notes and managing reference
- Download the reference
- Keeping taking notes
- Using a reference management tool

Part IX Summarizing and Reviewing
- Be prepared for your thesis/dissertation
- A literature review for your study topic
- The general review chapter(s) for your thesis/dissertation

Part X Learning writing from reading
- A good scientist is also a good writer
- Learn writing from reading
- Take a writing course, starting from writing a sentence …

Part XI Preparing for your future
- What career in conservation?
- What are your interests?
- Where are the information?
- Be prepared, always

Part XII Presentation of what you read
- Writing an outline
- Design your PPT
- Practice
- Be concise, confident, clear, remember the time limit is a key issue

The outlines for the presentations by student

Choosing one of the following topics, each student should give a 15-min presentation with his/her own PPTs, each give a 12-min talk + 3-min questions and comments by professors and his/her peer.

Tentative topics for student presentations:

a) My future study area
b) A hot domain/A new advance in science
c) I discovered something worth of further study in conservation/science

The key points in your presentation:

For Topic a) My future study area, you should talk about the following points:

- The back ground of the literature searching (What are current status of the field and how do you find the reference to the recent development?)
- The maintain discovery in the field (Talking about key literature in the field)
- The weakness in methodology, the knowledge gap in the field. or your plan to work on the issue in foreseeable future

For Topic b) A hot domain/A new advance in science, you should talk about the following points:

- The back ground of the literature searching (How do you find the topic?)
- The maintain discovery in the field (Talking about key literature in the field)
- The weakness in methodology, the knowledge gap in the field. or your comment of the development in the field.

For Topic c) I discovered something worth of further study in conservation/science, you should talk about the following points:

- How did you find the issue in reading?)
- The general introduction to the discovery
- Why do you think it is a hot topic? What is the likely impact on society or scientific work in foreseeable future?

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:

University level education in Biology, Biological Technology or applied biology sciences like Agricultural Science, Forestry Science, Environmental Science, Aquatic and Oceanic Sciences, Medical and Vet Science as well as in University level education in Education Science and Management Science

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:

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	*Class teaching 3h+After class discussion and Quiz 1h*
2	Histone modification / X-inactivation	*Class teaching 3h+After*

		class discussion and Quiz 1h
3	Histone variation / Epigenetics regulation in disease	*Class teaching 3h+After class discussion and Quiz 1h*
4	Chromatin remodeling / Epigenetics in flowering	*Class teaching 3h+After class discussion and Quiz 1h*
5	DNA methylation-establishment and maintenance / Imprinting	*Class teaching 3h+After class discussion and Quiz 1h*
6	DNA demethylation / Molecular tools to study DNA methylation	*Class teaching 3h+After class discussion and Quiz 1h*
7	Transgenerational epigenetic inheritance / Honey bee epigenome	*Class teaching 3h+After class discussion and Quiz 1h*
8	sRNA processing / Genetic engineering	*Class teaching 3h+After class discussion*

		and Quiz 1h
9	sRNA amplification and loading / RNA silencing function in plant immunity to virus	*Class teaching 3h+After class discussion and Quiz 1h*
10	Target recognition and action of sRNAs / Popular tools to study RNAi	*Class teaching 3h+After class discussion and Quiz 1h*
11	The modification and degradation of sRNAs / Animal virus and RNA silencing	*Class teaching 3h+After class discussion and Quiz 1h*
12	The movement of RNA silencing / Cross-kingdom RNAi	*Class teaching 3h+After class discussion and Quiz 1h*
13	The application of RNA silencing in research, human health and crop production	*Class teaching 3h+After class discussion and Quiz 1h*
14	Long non-coding RNA, Circular RNA and RNA modifications	*Class teaching 3h+After class discussion and Quiz 1h*

15	Bioinformatics tools to study RNA silencing and Epigenetic	*Class teaching 3h+After class discussion and Quiz 1h*
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	hours
1	Introduction of nano-biosensing and imaging technology	3
2	Nanostructured materials used for construction of biosensing and imaging systems	3
3	Surface functionalization of nanomaterials with biorecognition unit	3
4	Principles of biosensing and imaging design for overcoming biological barriers	3
5	Quantum dots-based fluorescent biosensing and imaging	3
6	Lanthanide ions-doped nanomaterials for luminescent biosensing and imaging	3
7	Fluorescent biosensors based on aggregation-induced emission	3
8	Flipped classroom- Fluorescent nanoparticles for biosensing and imaging	3
9	DNA nanotechnology for biosensing and imaging	3
10	Flipped classroom- DNA nanotechnology for biosensing and imaging	3
11	Mesoporous silica-based biosensing and imaging	3
12	Metal-organic frameworks-based biosensing and imaging	3
13	Flipped classroom- Porous nanoparticles for biosensing and imaging	3

14	Magnetic nanomaterials-based biosensing and imaging	3
15	Gold nanomaterials-based biosensing and imaging	3
16	Flipped classroom- Metal nanoparticles for biosensing and imaging	3
17	Carbon nanomaterials-based biosensing and imaging	3
18	Theranostics: Integration of Bioimaging with Therapy	3
19	Theranostics: Integration of Bioimaging with Therapy	3
20	Final exam	3
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

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 an integrated scientific theory that describes how the large-scale geologic structures on Earth are created as a result of Earth's plates movements. In plate tectonics, the lithosphere — Earth's strong, rigid outermost shell—is broken into many tectonic plates, which lie on top of the weaker, ductile asthenosphere. Due to the convection of the asthenosphere, the plates move relative to each other and interact along their boundaries, where they converge, diverge, or slip past one another. These interactions generate many phenomena, such as mountain building, large continents, wide and deep oceans, volcanoes and earthquakes. To begin our explanation of the key elements of plate tectonics theory, we will first learn about the physical and chemical structures of the earth, types of plate boundaries, subduction zones and other special locations on plates. We will see how continents break up, how they collide, what makes plates move, and their relationships with petrology, paleomagnetism and geodynamics.

We will then introduce the application of plate tectonics on Himalayan-Tibetan Orogen. The India-Eurasia collision is the most significant geological event throughout the Phanerozoic and eventually created the youngest and most spectacular Himalaya-Tibetan Orogen on Earth. During the continental collision, Indian continental lithosphere began to subduct beneath Eurasian continent and further induced large-scale deformation, magmatism and metamorphism. More importantly, the continental collision induced rapid uplift of the Himalaya-Tibetan Plateau. The uplift of the large and high elevations (>5000m) of the Tibetan Plateau has not only affected regional geomorphology and geographical environments of Asia, but also impacted on regional or even global climate change. Therefore, the Himalayan-Tibetan orogen provides an ideal natural laboratory to investigate the mountain building process in general. 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 2.1 Three Layers 2.2 Physical Properties 2.3 Chemical Compositions 3. Continental Drift 3.1 Principal Observations 3.2 The Implications 4. Seafloor Spreading 4.1 Seafloor Topography 4.2 Age of the Seafloor 4.3 Oceanic Ridge System	15

	5. Accreting Plate Boundaries 5.1 Divergent Plate Boundaries 5.2 Convergent Plate Boundaries 5.3 Transform Plate Boundaries 6. Subduction 6.1 Distribution of Subduction zones 6.2 Deep Structure of the Subduction Zones 7. Continents 7.1 The Growth of Continents 7.2 Continental Margins 8. Hotspots and Mantle Plumes 8.1 Mantle Convection 8.2 Surface Volcanisms 8.3 Deep Origin of Mantle Plumes 9. The Wilson Cycle 9.1 Traditional Wilson Cycle Model 9.2 The Implications 10. Planetary Perspective 10.1 The Early History 10.2 Comparative Planetary	
2	**Petrology and Plate Tectonics** 1. Introduction to Petrology and Plate Tectonics 1.1 Material composition of the Earth 1.2 What's the petrology? 1.3 Research methods 1.4 Plate Tectonics Review 1.5 Rocks in plate boundaries 1.6 Rocks in inner plate 2. Igneous Petrology 2.1 Fundamental concepts 2.2 Common rocks 2.3 Magma Generation 2.4 Magmatism and Plate Tectonics 3. Metamorphic Petrology: 3.1Fundamental concepts 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 4.2 Common rocks 4.3 "Bouma sequence" and "Galileo's free fall" 4.4 "Facies" and Palaeoenvironments 5. "Ophiolite" 5.1 What's ophiolite? 5.2 Contribution to the Tibetan Plateau	15
3	**Paleomagnetism and Plate Tectonics** 1. Introduction to Geomagnetism 1.1 Earth Magnetic Field 1.2 History 1.3 Study Fields	15

	2. Basic Rock Magnetism 2.1 Magnetic Properties 2.2 Magnetic Mineralogy 2.3 Magnetic Domains 2.4 Hysteresis 2.5 Natural Remanent Magnetism (NRM) 3. Sampling, Measurement, Analysis and Field Tests 3.1 Collection of Paleomagnetic Samples 3.2 Demagnetization Techniques 3.3 Display and Bedding-tilt Correction 3.4 Identification of Ferromagnetic Minerals 3.5 The Fold Test 3.6 Synfolding Magnetization 3.7 Conglomerate Test 3.8 Reversals Test 3.9 Baked Contact and Consistency Tests 3.10 Other Tests 4. Magnetic Reversals and Inclination Shallowing 4.1 Magnetic Reversals 4.2 Paleomagnetic Geochronlogy 4.3 Inclination Shallowing 5. Plate Tectonics and Sea Floor Spreading 5.1 Plate Tectonic Theory and Paleomagnetism 5.2 Sea Floor Spreading Hypothesis and Paleomagnetism 6. Paleomagnetic Poles and Paleogeographic Reconstruction 6.1 Procedure for Pole Determination 6.2 Types of Poles 6.3 Sampling of Geomagnetic Secular Variation 6.4 Paleogeographic Reconstruction 7. Regional Tectonics-Collision and Shortening 7.1 Evolution of the Tibetan Plateau and Tethys 7.2 India-Asia Collision Time and Shortening 7.3 Regional Tectonics-Regional Rotations 7.4 Rotations of the NE Tibetan Plateau 7.5 Rotations of the SE Tibetan Plateau 7.6 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	15

	3.2 Uniaxial stress and strain 3.3 Plane stress and strain 3.4 Pure and simple shear 3.5 Bending and flexure of plate in two dimensions 3.6 Flexure with basin and mountain tectonics 4. Rock Rheology 4.1 Diffusion creep 4.2 Dislocation creep 4.3 Temperature- and stress-dependent rheology 4.4 Crustal rheology and viscoelasticity 4.5 Mantle convection and plate motions 5. Faulting 5.1 Classification of Faults 5.2 Mohr-circle theory 5.3 Friction on faults 5.4 Anderson theory of faulting 5.5 Coulomb failure criterion and strength envelop 5.6 Earthquake faulting 6. Geodynamic remarks of on the Tibetan plateau 6.1 Deformation from plate boundary to plate interior 6.2 Decadal to millennia time-dependent deformation 6.3 Available geodynamic models of the Tibetan plateau	
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. Process of Gondwana split and 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 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 4. The Raising of Tibet plateau 4.1 Index of paleoelevation 4.2 The raising of Himalaya 4.3 The raising of Tibet	12
5	Exam	3
Total		75

Course title

Physical Geography

Instructor(s):

Prof. XiaoMin Fang et al.

Course type:

Lecture

Catalog Description:

Physical Geography 2022 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	Time	Classroom	Date
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 **(After-school materials distribution)**	Tue. 13:30-16:20 Class5-7	Tencent Meeting 49178382287	1-Mar 方小敏老师
2	**Global Energy Balance** 2.1 Insolation to the earth 2.2 Global energy system 2.3 Energy redistribution and climate change **(After-school materials distribution)**	Tue. 13:30-16:20 Class5-7		8-Mar
3	**Winds and Global Circulation** 3.1 Air pressure, wind and cyclones-anticyclones 3.2 Wind circulation 3.3 Ocean circulation **(After-school materials distribution)**	Tue. 13:30-16:20 Class5-7		15-Mar
4	**Weather Systems** 4.1 Air masses and fronts 4.2 Midlatitude anticyclones an cyclones 4.3 Tropic and equatorial weather systems **(After-school materials distribution)**	Tue. 13:30-16:20 Class5-7		22-Mar
5	**Earth materials** 5.1 The structure of the earth 5.2 Earth materials and rocks **(After-school materials distribution)**	Tue. 13:30-16:20 Class5-7		29-Mar
6	**Tectonics and Landforms** 61 Plate tectonics and global topography 6.2 Tectonic landforms 6.2 Volcanic activity and landforms **(After-school materials distribution)**	Tue. 13:30-16:20 Class5-7		5-Apr

7	**Air Temperature, Moisture and Precipitation** 7.1 Air temperature and vertical temperature structure 7.2Temperature change 7.3 Moisture and humidity 7.4 Precipitation formation and types **(After-school materials distribution)**	Tue. 13:30- 16:20 Class5-7		12-Apr 张凡 老师
8	**Global Climates and Climate Change** 8.1 Climate and classification 8.2 Climate with latitude 8.3 climate change and causes 8.4 Mini-seminars: -student presentations and discussion **(After-school materials distribution)**	Tue. 13:30- 16:20 Class5-7		19-Apr
9	**Weathering and Mass Wasting** 9.1 Weathering 9.2 Mass Wasting **Freshwater of the Continents** 10.1 Hydrologic Cycle 10.2 Groundwater **(After-school materials distribution)**	Tue. 13:30- 16:20 Class5-7		26-Apr
10	10.3 Streamflow 10.4 Lakes 10.5 Hydrological Model 10.6 Water as a Natural Resource **(After-school materials distribution)**	Tue. 13:30- 16:20 Class5-7		3-May
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 **(After-school materials distribution)**	Tue. 13:30- 16:20 Class5-7		10-May
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 **(After-school materials distribution)**	Tue. 13:30- 16:20 Class5-7		17-May 朱立平 老师
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 **(After-school materials distribution)**	Tue. 13:30- 16:20 Class5-7		24-May
14	**Landforms Made by Wave and Wind** 14.1 The Work of Waves and Tides	Tue. 13:30-		31-May

	14.2 Coastal Landforms 14.3 Wind Action 14.4 Eolian Landforms **(After-school materials distribution)**	16:20 Class5-7		
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 **(After-school materials distribution)**	Tue. 13:30- 16:20 Class5-7		7-Jun

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 2022 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	Date
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	3	28-Feb
2 Prof. Yaoming Ma	**Radiation and the Earth's energy balance** 2.1 Solar and terrestrial radiation 2.2 Solar variability 2.3 Summary	3	7-Mar
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	3	14-Mar

3" Prof. Yaoming Ma	**Climate Change review**	**3**	**19-Mar**
4 Prof. Baiqing Xu	**Evidence of climate change** 8.1 Peering into the abyss of time 8.2 From greenhouse to icehouse 8.3 Sea-level fluctuations 8.4 The ice ages 8.5 The end of the last ice age 8.6 The Holocene climatic optimum 8.7 Changes during times of recorded history 8.8 The medieval climatic optimum 8.9 The Little Ice Age 8.10 The twentieth-century warming 8.11 Concluding observations	3	21-Mar
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	3	28-Mar
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	3	4-Apr
6" Prof. Baiqing Xu	**climate change review 2**	**3**	**9-Apr**
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	3	11-Apr
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	3	18-Apr

	5.6 Multidimensional analysis 5.7 Summary		
9 Prof. Lei Wang	**Consequences of climate change** 9.1 Geological consequences 9.2 Flora and fauna 9.3 Mass extinctions 9.4 Sea levels, ice sheets and glaciers 9.5 Agriculture 9.6 The historical implications of climatic variability 9.7 Spread of diseases 9.8 The economic impact of extreme weather events 9.9 Summary	3	25-Apr
9" Prof. Lei Wang	**climate change review 3**	**3**	**30-Apr**
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	3	2-May
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	3	9-May
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?	3	16-May
12" Prof. Yimin Liu	**climate change review 4**	**3**	**21-May**
13 Prof. Lei Wang	Hydrological modelling and its applications for integrated water resources management	3	23-May
14 Prof. Yimin Liu	Role of the modelling on scientific understanding II monsoon varibility 13.1 Byweekly 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	3	30-May

	monsoon and the Tibetan Plateau impact		
15 Prof. Baiqing Xu	Back carbon in the glacier area	3	6-Jun
16 Prof. Yaoming Ma	Land surface heat flux retrieve from in-situ data, remote sensing data and numerical model	3	13-Jun
4 Professors	**climate change review 5**	**3**	**18-Jun**
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 Schedule:

4 hrs/week: 3 hrs. lecture by Instructors, 1 hr. Offline Reading Course.

Course Assessment:

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

Grading Policy:

Assignments 30%, Final 70%

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	Concept of chemical reaction engineering	1
		Chemical reaction engineering and safety	2
		Chemical reaction engineering application	1 (*Offline Course*)
2	Homogeneous Reaction Kinetics	Concentration-Dependent term of a rate equation	1
		Temperature-Dependent term of a rate equation	2
		Searching for a mechanism	1 (*Offline Course*)
		Predictability of reaction rate from theory	2
3	The Kinetics of Gas-Solid Phase Catalysis	Introduction to catalysis	0.5
		Comparison between homogeneous and heterogeneous catalysis	0.5
		Catalysts composition	1 (*Offline Course*)
		Catalyst deactivation and regeneration	1
		Steps in gas-solids catalysis	2
		Adsorption at the gas-solids interface	1.5
		Adsorption modes	1.5
		Process for establishing kinetic models	2 (*Offline Course*)
4	Macro-Kinetics of	Transport and reaction at phase boundaries	1

	Gas-Solid Phase Catalysis	The diffusion of gas in solid particles	1
		The distribution of gas concentration and temperature in solid particles.	1
		The correlation of the macroscopic reaction rate	1 (*Offline Course*)
5	Autoclave Type and Homogeneous Tubular Reactor	Types of ideal reactors	1.5
		Autoclave type reactor	1.5
		Homogeneous tubular reactor	1 (*Offline Course*)
6	Gas-Solid Phase Catalytic Reaction Fixed Bed Reactor	Main types of fixed bed catalytic reactor	1.5
		Physical parameters of fixed bed reactor	1.5
		Mass transfer and heat transfer in fixed bed reactor	1 (*Offline Course*)
7	Gas-Solid Phase Catalytic Reaction Fluidized Bed Reactor	Concept of fluidized bed reactor	1
		Fluidization phenomenon	2
		Geldart classification of solids	1 (*Offline Course*)
8	Gas-Liquid Reaction and Bubbling Reactor	Theory sketch	2
		Mass transfer with irreversible and reversible reactions	2
9	The Gas-Liquid Reaction Process and the Reactor	Mass transfer theories	2
		Key multiphase reactors	2 (*Offline Course*)
10	Liquid-Solid Reaction and Fluid Bed Reactor	liquid-solid reaction process	3
		Application of fluidized bed reactor	1 (*Offline Course*)
11	Gas-Liquid-Solid Reaction Engineering	Types of gas-liquid-solid Reactors	2
		Macroscopic reaction kinetics	2
		Application examples	2
		Discussion and prospect	2 (*Offline Course*)
12	Safety of chemical reaction process and Design of reactor	General rules of safety	1
		Examples of chemical reaction process safety	2
		Reactor design	1 (*Offline Course*)

Textbook and any related course material:

1. *Reaction Engineering, 李绍芬，2019.01，化学工业出版社*
2. *Multi-Phase Chemical Reaction Engineering and Technology，金涌，2006.05，清华大学出版社*
3. *Chemical Reaction Engineering, Octave Levenspiel, 1998.08, Wiley.*
4. *Concepts of Modern Catalysis and Kinetics, Ib Chorkendorff, Hans Niemantsverdriet, 2003.10, Wiley.*

5. Fundamentals of chemical reaction engineering, Mark Davis and Robert Davis, 2003, McGraw-Hill (MHP)

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: 14 assignments, presentations

Grading Policy:

Assignments literature report 40%, Final Report 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	Class teaching 3h+literature reporting 1h
2	Task of green chemistry	Class teaching 3h+literature reporting 1h
3	Green chemistry and catalysis	Class teaching 3h+literature reporting 1h
4	biocatalysis	Class teaching 3h+literature reporting 1h
5	Photo-catalysis	Class teaching 3h+literature reporting 1h
6	Electro-catalysis	Class teaching 3h+literature reporting 1h
7	Solid catalyst, Acid and Base	Class teaching 3h+literature reporting 1h
8	Ionic liquid and other non-organic solvents	Class teaching 3h+literature reporting 1h
9	Chemical separation	Class teaching

		3h+literature reporting 1h
10	Working without organic solvent	Class teaching 3h+literature reporting 1h
11	Agrochemicals	Class teaching 3h+literature reporting 1h
12	Sustainable materials	Class teaching 3h+literature reporting 1h
13	Design of safe and harmless chemicals	Class teaching 3h+literature reporting 1h
14	chemistry of long wear	Class teaching 3h+literature reporting 1h
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 Schedule:

4 hours/week: 3 hours lecture by Instructors; 1 hour offline literature reading and discussion.

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 teaching 3h +Literature reading and discussion 1h
2	Particle characterization; single particle motion; response time	Class teaching 3h +Literature reading and discussion 1h
3	Flow regime diagram; criteria of transition; particulate and aggregative fluidization; stability analysis	Class teaching 3h +Literature reading and discussion 1h
4	Bubbling fluidization; bubble dynamics	Class teaching 3h +Literature reading and discussion 1h
5	Distributor design; entrainment and elutriation	Class teaching 3h +Literature reading and discussion 1h
6	Scale-up and scale-down of fluidized bed	Class teaching 3h +Literature reading and discussion 1h
7	Circulating fluidized bed; choking phenomena and prediction	Class teaching 3h +Literature reading and discussion 1h
8	Generalized fluidization and downer	Class teaching 3h +Literature reading and discussion 1h
9	Cyclone and separator design; mass and heat transfer	Class teaching 3h

		+Literature reading and discussion 1h
10	Particle-fluid mass transfer and heat transfer; wall-to-bed heat transfer	Class teaching 3h +Literature reading and discussion 1h
11	Introduction to multiphase fluid dynamics; multiphase flow models	Class teaching 3h +Literature reading and discussion 1h
12	Continuum modeling and scale seperation; two-fluid model (TFM)	Class teaching 3h +Literature reading and discussion 1h
13	Introduction to kinetic theory; drag force; multiscale models	Class teaching 3h
14	Advanced modeling: mesoscale approaches	Class teaching 3h
15	Introduction to simplified solution; bubbling simulation; clustering simulation; reactive simulation; perspective	Class teaching 3h +Simulation and discussion 1h
16	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

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

Instructor(s)-in-charge:

Prof. QI Youcun & Associate Prof. XUE Ming & Prof. DONG Jinwei

Course type:

Lecture

Course Schedule:

3hrs/week by instructor plus 1hr/week discussion using WeChat Group .

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	Date	Instructor
1	**Course Introduction, Introductory Lecture** Concepts, principle	2023-02-27	Youcun Qi
2	**Course Introduction, Introductory Lecture** Concepts, principle **Basic of Remote Sensing** Major Sensors for monitoring climate change	2023-03-06	Youcun Qi
3	**Basic of Remote Sensing** Major Sensors for monitoring land use change Major Sensors for monitoring severe weather	2023-03-13	Youcun Qi
4	**Methods of data processing and analyses** Remote sensing data	2023-03-20	Youcun Qi

	processing, Data visualization		
5	**Remote Sensing of Climate Change** Generating the remote sensing data Rainfall detection, Snow coverage and depth detection	2023-03-27	Youcun Qi
6	**Remote Sensing of Climate Change** Existing climate data and the applications Data collection and Accuracy Assessment	2023-04-03	Youcun Qi
7	**Remote Sensing of Climate Change** Snow coverage and depth monitoring	2023-04-10	Youcun Qi
8	**Remote Sensing of Climate Change** Rainfall types and changes	2023-04-17	Youcun Qi
9	**Methods of data processing and analyses** Land classification methods Machine learning, etc. **Remote Sensing of Land use change** Existing land use maps and the applications Land use mapping and change detection	2023-04-24	Jinwei Dong
10	**Basic of Remote Sensing** Major Sensors for monitoring severe weather Fundamentals in Satellite/Radar imagery and severe weather	2023-05-01	Ming Xue
11	**Basic of Remote Sensing** Basic information of radiances measured by satellites/Radar and its relationship with atmospheric dynamics	2023-05-08	Ming Xue
12	**Methods of data processing and analyses** Interpreting satellite/radar imagery Severe weather analyses	2023-05-15	Ming Xue
13	**Remote Sensing of Severe weather** Radar imagery analysis of main ingredients of severe weather situations	2023-05-22	Ming Xue
14	**Remote Sensing of Severe weather** Use of Radar imagery for assessing numerical prediction model behavior	2023-05-29	Ming Xue
15	**Presentation of the Final Project, and Final Exam**	2023-06-05	Youcun Qi

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

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

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		Content
1	Systematics Foundations	3	1	Evolutionary Biology
			2	Tree of Life
			3	Classification and Phylogeny
			4	Biodiversity Macroevolution
2	Molecular Systematics	3	1	Species Delimitation
			2	Species Interactions
3	Molecular Phylogenetics and Phylogenomics	3	1	Phylogenetics Trees
			2	Tree Thinking
			3	Molecular Phylogenetics
			4	Phylogenetic Data
			5	Phylogenetic Methods

			6	Phylogenomics
			7	Gene Tree and Species Tree
4	Species Theories and Molecular Species Delimitation	3	1	Available Species Concepts
			2	Hypotheses of Speciation
			3	Controversies of 'species'
			4	Recent developments of the species concept
			5	Molecular Species Delimitation and Case Studies
5	Student Presentation	3	1	Student Presentation
6	Molecular Ecology Background	3	1	Molecular Markers
			2	DNA Taxonomy and DNA Barcoding
			3	Metabarcoding
			4	Genetics in Biogeography
7	Applied DNA Barcoding	3	1	Phylogenetics for Molecular Ecology
			2	Integrating Omics with DNA Barcodes
			3	Multi-Faceted Molecular Profiling
8	Phylogeography and Conservation	3	1	Case Studies
9	Student Presentation	3	1	Student Presentation
10	Classification and the Tree of Life	3	1	Macroevolution Basics
			2	Plant Evolution
			3	Animal Evolution
			4	Human Evolution
11	Molecular Clock and Estimating Evolutionary Timescales	3	1	Bayesian Phylogenetic Analysis
			2	Markov Chain Monte Carlo Sampling
			3	The Molecular Evolutionary Clock
			4	Estimating Evolutionary Timescales

			5	Framework of Bayesian Molecular Clock Dating
			6	Molecular Clock Dating with BEAST 2
12	Q&A or Lab Tour	3	1	Q&A or Lab Tour
13	Final Examination	4	1	Final Examination

Textbook and any related course material:

The Phylogenetic Handbook: A Practical Approach to Phylogenetic Analysis and Hypothesis Testing, edited by Philippe Lemey, Marco Salemi, and Anne-Mieke Vandamme, 2009, Cambridge University Press;

Phylogenetics in the Genomic Era, edited by Celine Scornavacca, Frédéric Delsuc, Nicolas Galtier, 2020, No commercial publisher, Authors open access book, hal-02535070.

The Molecular Evolutionary Clock: Theory and Practice, edited by Simon YW Ho, 2020, Springer.

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*