#

# COURSE CATALOG

# 2020-2021 Spring Semester

# Online

# International College of UCAS

目录

[COURSE CATALOG 1](#_Toc62053712)

[2020-2021 Spring Semester 1](#_Toc62053713)

[Online 1](#_Toc62053714)

[International College of UCAS 1](#_Toc62053715)

**[General Introduction](#_Toc62053716)** [3](#_Toc62053716)

**[1.](#_Toc62053717)****[Course Selection System-for Professional Courses Only](#_Toc62053717)** [3](#_Toc62053717)

**[2.](#_Toc62053718)****[General Degree Requirements for Doctors](#_Toc62053718)** [3](#_Toc62053718)

**[3.](#_Toc62053719)****[General Degree Requirements for Masters](#_Toc62053719)** [3](#_Toc62053719)

**[4.](#_Toc62053720)****[General Degree Requirements for MD-PhD Students](#_Toc62053720)** [3](#_Toc62053720)

**[5.](#_Toc62053721)****[Courses Type](#_Toc62053721)** [4](#_Toc62053721)

**[6.](#_Toc62053722)****[Rules about courses results](#_Toc62053722)** [5](#_Toc62053722)

**[7.](#_Toc62053723)****[Contact Information](#_Toc62053723)** [5](#_Toc62053723)

**[Plant Physiology and Ecology](#_Toc62053724)** [12](#_Toc62053724)

**[Nano-biology](#_Toc62053725)** [13](#_Toc62053725)

**[Molecular Entomology and Plant Pathology](#_Toc62053726)** [15](#_Toc62053726)

**[Biochemistry](#_Toc62053727)** [17](#_Toc62053727)

**[Conservation Biology](#_Toc62053728)** [19](#_Toc62053728)

**[Vector and human pathogen](#_Toc62053729)** [23](#_Toc62053729)

**[Introduction to Epigenetics and RNA silencing](#_Toc62053730)** [25](#_Toc62053730)

**[Nanobiological Sensing and Detection](#_Toc62053731)** [27](#_Toc62053731)

**[Nanotechnology for Solar Energy Utilization Applications](#_Toc62053732)** [28](#_Toc62053732)

**[Nano Electronic Materials](#_Toc62053733)** [30](#_Toc62053733)

**[Plate Tectonics and Evolution of Tibetan Plateau](#_Toc62053734)** [31](#_Toc62053734)

**[Physical Geography](#_Toc62053735)** [37](#_Toc62053735)

**[Global Change Ecology](#_Toc62053736)** [39](#_Toc62053736)

**[Chemical Reaction Engineering](#_Toc62053737)** [44](#_Toc62053737)

**[Energy Chemistry and Energy Chemical Industry](#_Toc62053738)** [45](#_Toc62053738)

**[Green Chemistry and Engineering](#_Toc62053739)** [46](#_Toc62053739)

**[Fluidization and Multiphase Flow](#_Toc62053740)** [47](#_Toc62053740)

**[Applied Statistics](#_Toc62053741)** [48](#_Toc62053741)

**[Applications of Remote Sensing on Climate Change, Land Science and Severe Weather](#_Toc62053742)** [49](#_Toc62053742)

**[Expected level of proficiency from students entering the course:](#_Toc62053743)** [52](#_Toc62053743)

**[Water Chemistry](#_Toc62053744)** [53](#_Toc62053744)

**[Fundamental for Internet of Things and Its Applications](#_Toc62053745)** [55](#_Toc62053745)

**[Biodiversity science](#_Toc62053746)** [58](#_Toc62053746)

**[Development Geography](#_Toc62053747)** [62](#_Toc62053747)

**[Integrative Systematic Biology](#_Toc62053748)** [66](#_Toc62053748)

**General Introduction**

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

This course selection system is for students registering professional courses online. From this semester all the courses will be opened for all students including Chinese students and International students. Because the capacity of every course is limited and first come first select, this system will be opened during Jan. 20th –Jan. 30th, 2021 and the students from International College can register first. Please use the google chrome or 360 browsers. Do not choose two courses schedule overlap.

All students should select Academic Morality and Writing Norms in this system as it is the public compulsory course.

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

 **Username: Your email address**

 **Original password: 123456**

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

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

1. **General Degree Requirements for Doctors**

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

1. **General Degree Requirements for Masters**

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

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

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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** |

1. **Courses Type**

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

**5.1 Public compulsory courses (7 credits in total)—Degree Courses**

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

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

(3) China Panorama (2 credits).

(4) Academic Morality and Writing Norms (1 credits).

These four Public compulsory courses are Degree Courses for all international students. Students who has only finished two public compulsory courses online (Elementary Chinese-Reading and Writing and China Panorama) in the autumn semester should finish Elementary Chinese-Listening and Speaking online in the same language class with the same Chinese teacher in the spring semester. **All students should take Academic Morality and Writing Norms as it is required for graduation.**

However, we have a rule about **Course Waiver**. Students who can meet one of the conditions can apply for course waiver and will get 6 credits directly (**except Academic Morality and Writing Norms**).

A. Providing a certificate of HSK Level 3;

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

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

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

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

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

All the optional courses are non-degree courses.

1. **Rules about courses results**

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

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

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

The Public compulsory courses are all Degree courses.

1. **Contact Information**

Education Coordinator for Professional Courses:

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

Education Coordinator for Public compulsory courses:

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

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Name** | **Type** | **Hours/Credits** | **Date&Time** | **VooV Meeting** | **Professors** | **First Class Date** | **Assistant teacher** |
| 0713I0D01001H | Plant Physiology and Ecology | Professional courses | 51/3.0 | Thur.(13:30-17:10) | ID-43288938501;Code-123456 | Qu Laiye | Mar.13th | xyyuan@rcees.ac.cn |
| 0710I0D01006H | Nano-biology | Professional courses | 50/3.0 | Wed. (08:30-12:10) | ID-89295532179 | CHEN Deliang et al. | Mar.10th | yangqifan19@mails.ucas.ac.cn |
| 0710I0D01008H | Molecular Entomology and Plant Pathology | Professional courses | 51/3.0 | Tue.(13:30-17:10) | ID-40648724376;Code-123676 | ZOU Zhen et al. | Mar.9th | jiangh@ioz.ac.cn |
| 0710I0D01009H | Biochemistry | Professional courses | 60/4.0 | Tue.(08:30-12:10) | ID-54094287777 | ZHONG Liangwei et al. | Mar.9th | kongfei18@mails.ucas.ac.cn |
| 0710I0D01013H | Conservation Biology | Professional courses | 60/4.0 | Tue.(13:30-17:10) | ID-30222352865 | JIANG Zhigang | Mar.9th | evansowuor4@gmail.com |
| 0710I0D01007H | Vector and Human Pathogen | Professional courses | 51/3.0 | Thur.(08:30-12:10) | ID-76595009614 | ZHENG Aihua et al. | Mar.11th | zhangxing@ucas.ac.cn |
| 0710I0D01010H | Introduction to Epigenetics and RNA Silencing | Professional courses | 60/4.0 | Thur.(13:30-17:10) | ID-84635059545 | ZHANG Xiaoming et al. | Mar.11th | liqi@ioz.ac.cn |
| 0710I0D01011H | Nanobiological Sensing and Detection | Professional courses | 60/4.0 | Tue.(14:00-18:00) | ID-97973144401 | LI Lele | Mar.9th | zhaojian@nanoctr.cn |
| 0703I0D01002H | Nanotechnology for Solar Energy Utilization | Professional courses | 50/3.0 | Thur.(13:30-17:10) | ID-82885894952 | HE Tao | Mar.11th | wangyanjie@nanoctr.cn |
| 0703I0D01003H | Nano Electronic Materials | Professional courses  | 52/3.0 | Wed.(13:30-17:10) | ID-59962348503 | XIE Liming | Mar.10th | wujuanxia@nanoctr.cn |
| 0709I0D01001H | Plate Tectonics and Evolution of Tibetan Plateau | Professional courses | 75/5.0 | Tue.(13:30-16:20)&Thur.(13:30-16:20) | Tue-72521090029; Thur-55160339501 | DING Lin et al. | Mar.11th | flcai@itpcas.ac.cn |
| 0705I0D01001H  | Physical Geography | Professional courses  | 60/4.0 | Tue.(13:30-17:10) | ID-62489321538 | FANG Xiaomin et al. | Mar.9th | kangjian@itpcas.ac.cn |
| 0713I0D01002H | Global Change Ecology | Professional courses  | 60/4.0 | Wed.(13:30-17:10) | ID-31332849245 | WANG Tao et al. | Mar.10th | liu.dan@itpcas.ac.cn |
| 0706I0D01001H | Climate Change | Professional courses | 64/4.0 | Mon.(08:30-12:10) | ID-99342218639 | MA Yaoming et al. | Mar.8th | wqma@itpcas.ac.cn |
| 0817I0D01001H | Chemical Reaction Engineering | Professional courses | 60/4.0 | Tue.(08:30-12:10) | ID-81469317762;Code-2021 | LI Chunshan et al. | Mar.9th | yxia@ipe.ac.cn |
| 0817I0D01003H | Energy Chemistry and Chemical Engineering | Professional courses | 60/4.0 | Mon.(13:30-17:10) | ID-8213833 3356;Code-0817 | LI Songgeng et al. | Mar.8th | haorongjiang18@mails.ucas.ac.cn |
| 0817I0D01002H | Green Chemical Engineering | Professional courses | 60/4.0 | Wed.(08:30-12:10) | ID-68216476730 | ZHANG Guangjin | Mar.10th | wanghaifan20@mails.ucas.ac.cn |
| 0817I0D01005H | Fluidization and Multiphase Flow | Professional courses | 60/4.0 | Tue.(13:30-17:10) | ID-47462931836 | WANG Wei | Mar.9th | tianyj@ipe.ac.cn |
| 0714I0D01002H | Applied Statistics | Professional courses | 50/3.0 | Wed.(13:30-17:10) | ID-66874786241 | WANG Qian | Mar.10th | 15879026322@163.com |
| 0705I0D01007H | Applications of Remote Sensing on Climate Change, Land Science and Severe Weather | Professional courses | 60/4.0 | Tue(08:30-12:10) | ID-56549658085; Code-123321 | QI Youcun et al. | Mar.9th | lidh@igsnrr.ac.cn |
| 0830I0D01005H | Water Chemistry | Professional courses | 60/4.0 | Tue.(13:30-16:20)&Thur.(13:30-16:20) | Tue-56045268000;Thur-41789375654 | DONG Huiyu et al. | Mar.9th | wangao201@mails.ucas.ac.cn |
| 0812I0D01003H | Fundamental for Internet of Things and Its Applications  | Professional courses | 50/3.0 | Mon.(18:30-22:00) | ID-66343525430; Code-010211 | YI Weidong | Mar.8th | xieshijun19@mails.ucas.ac.cn |
| 0710I0D01014H | Biodiversity Science | Professional courses | 50/3.0 | Mon.(13:30-16:20) | ID-98718217959;Code-2021 | MA Keping et al. | Mar.8th | niuhs@ucas.ac.cn |
| 0705I0D01006H | Development Geography | Professional courses | 60/4.0 | Tue.(19:00-21:50)&Satur.(19:00-21:50) | Tue-71892445431; Satur-79846772241 | DENG Xiangzheng et al. | Mar.9th | pengl.18b@igsnrr.ac.cn  |
| 0710I0D01015H | Integrative Systematic Biology | Professional courses | 51/3.0 | Fri.(19:00-22:00pm) | ID-33238264694 | ZHU Chaodong et al. | Mar.5th | michael.christopher.orr@gmail.com |
| 050200DGX001H-1 | Academic Communication for International Conferences | Optional courses | 40/1.0 | Tue.(08:30-12:10) | ID-71748482924;Code-0901 | YU Hua | Mar.9th | zhouyingkun15@mails.ucas.ac.cn |
| 050200DGX001H-2 | Academic Communication for International Conferences | Optional courses | 40/1.0 | Thur.(18:30-22:00) | ID-85133292111 | FANG Jiashun | Mar.11th | wangpeng20@mails.ucas.ac.cn |

**Public compulsory courses**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Class No.** | **Code** | **Name** | **Hours/****Credits** | **Date&Time** | **VooV Meeting ID** | **Professors** | **First Class** | **Assistant teacher** |
| Y-1 | 050102DGB002H-1 | Elementary Chinese-Listening and Speaking | 128/2.0 | Mon.(8:30-12:10) | 607 9163 6091 | LIU Xiaomeng | Mar. 8th | joe06082000@163.com |
| Thur.(8:30-12:10) | 552 3223 2043 |
| Y-2 | 050102DGB002H-2 | Elementary Chinese-Listening and Speaking | 128/2.0 | Mon.(8:30-12:10) | 545 1676 9213 | HE Fei | Mar. 8th | mengzhilv221@126.com |
| Thur.(8:30-12:10) | 449 3862 9694 |
| Y-3 | 050102DGB002H-3 | Elementary Chinese-Listening and Speaking | 128/2.0 | Mon.(8:30-12:10) | 979 7378 9572 | LI Ya | Mar. 8th | xiaoying796@163.com |
| Thur.(8:30-12:10) | 440 6775 5237 |
| Y-4 | 050102DGB002H-4 | Elementary Chinese-Listening and Speaking | 128/2.0 | Mon.(8:30-12:10) | 863 6382 4175 | LI Ran | Mar. 8th | liran1008@126.com |
| Thur.(8:30-12:10) | 470 9451 9056 |
| Y-5 | 050102DGB002H-5 | Elementary Chinese-Listening and Speaking | 128/2.0 | Mon.(8:30-12:10) | 930 1470 1324 | LUO Lei | Mar. 8th | sonialo@163.com |
| Thur.(8:30-12:10) | 809 3647 0785 |
| Y-6 | 050102DGB002H-6 | Elementary Chinese-Listening and Speaking | 128/2.0 | Mon.(8:30-12:10) | 806 3457 5866 | LUO Wei | Mar. 8th | luowei\_official@163.com |
| Thur.(8:30-12:10) | 617 8117 8055 |
| Y-7 | 050102DGB002H-7 | Elementary Chinese-Listening and Speaking | 128/2.0 | Mon.(8:30-12:10) | 746 3333 8915 | WANG Lei | Mar. 8th | 1625355608@qq.com |
| Thur.(8:30-12:10) | 706 5376 0013 |
| A-1 | 120500MGB011H-1 | Academic Morality and Writing Norms | 20/1.0 | Thur.(18:30-22:00) | 836 7926 2043Code:210311 | YE Qing | Mar. 11th | caosihe20@mails.ucas.ac.cn |
| A-2 | 120500MGB011H-2 | Academic Morality and Writing Norms | 20/1.0 | Thur.(18:30-22:00) | 836 7926 2043Code:210311 | YE Qing | Apr.29th |
| A-3 | 120500MGB011H-3 | Academic Morality and Writing Norms | 20/1.0 | Mon.(14:20-17:10) | 634 8356 5581 | YU Jun& LAN Li | Mar. 8th | shannon0525y@gmail.com |
| A-4 | 120500MGB011H-4 | Academic Morality and Writing Norms | 20/1.0 | Mon.(14:20-17:10) | 326 5757 6757 | YU Jun& LAN Li | Apr.26th | panyitong@aliyun.com |

**Course title:**

**Plant Physiology and Ecology**

**Instructor:**

*Associate Prof. Laiye Qu*

**Course type:***Lecture*

**Course Assessment:**

*None*

**Grading Policy:**

*Registration (17% of the final score)*

*one report (50% of the final score)*

*one quiz (33% of the final score)*

**Course Prerequisites:**

*None*

**Catalog Description:**

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

**Schedule of the course**

|  |  |  |
| --- | --- | --- |
| No. | Objectives | Remarks |
| 1. | General Introduction |  |
| 2. | Plant adaption |  |
| 3. | Photosynthesis |  |
| 4. | Respiration |  |
| 5. | Plant water relations |  |
| 6. | Mineral nutrients |  |
| 7. | Nitrogen |  |
| 8. | Decomposition  |  |
| 9. | Phosphorus | Report |
| 10. | Mycorrhiza |  |
| 11. | Multiple relationship |  |
| 12. | Growth and allocation |  |
| 13. | Restoration |  |
| 14. | Succession |  |
| 15. | Plant-soil feedback |  |
| 16. | General discussion  |  |
| 17 | Examination | Presentation |

**Course title**

**Nano-biology**

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

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

**Course type:**

*Lecture*

**Course Schedule:**

*See Schedule of the course*

**Course Assessment:**

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

**Grading Policy:**

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

**Course Prerequisites:**

*No.*

**Catalog Description:**

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

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |  |
| --- | --- | --- | --- |
| section | content |  | hours |
| 1 | Introduction to Nanobiology | History, Progress and Objectives of Nanobiogy. | 6 |
| 2 | Structural Principles in Bio-nanomaterials | Building Block of Bio-nanomaterials; Protein Nanostructures; DNA Nanostructures; Lipid Nanostructures. | 12 |
| 3 | Functional Principles in Bio-nanomaterials | Energy Conversion;Chemical Synthesis;Transport and Transduction. | 10 |
| 4 | Progress and hot Topics in Nanobiology | Design of Bio-nanomaterials;Self-assembly and Recognition;Biomolecule Motors;DNA/Protein Computing; Biosensors;Nanomedicines. | 12 |
| 5 | Techniques and Approaches in Nanobiology | Single Molecule Imaging: STED, STORM, PALM; Single Molecule Structure Determination: EM, X-ray diffraction;Single Molecule Manipulating: AFM, STM, OT, MT.  | 10 |
| total |  |  | 50 |

 |

**Contents of the course**

*See the contents in the course schedule*

**Textbook and any related course material**

*Bionanotechnology: lessons from nature; 1st edition*

*David S. Goodsell,*

*Wiley-Liss, Inc. 2004*

*References will be provided in class.*

**Course title**

**Molecular Entomology and Plant Pathology**

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

*Prof. ZOU Zhen*

*Prof. LI Xiang-Dong*

*Prof. LIU Jun*

**Course type:**

*Lecture*

**Course Assessment:**

*Quiz, exams, and home work*

**Grading Policy:**

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

**Course Prerequisites:**

*Without*

**Catalog Description:**

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

**Schedule of the course**

|  |  |  |
| --- | --- | --- |
| section | content | Lecturer |
| 1 | Introduction to entomology | Zhen Zou |
| 2 | DNA synthesis, transcription, and translation | Zhen Zou |
| 3 | Insect transgenesis and comparative genomics | Zhen Zou |
| 4 | Molecular Systematics and Phylogeny | Zhen Zou |
| 5 | Circulatory system, Endocrinology and Reproduction /First Exam | Zhen Zou |
| 6 | Insect Nervous Systems | Xiangdong Li |
| 7 | Insect Visual Signaling | Xiangdong Li |
| 8 | Insect Chemical Communication | Xiangdong Li |
| 9 | Insect Mechanical Communication I | Xiangdong Li |
| 10 | Insect Mechanical Communication II | Xiangdong Li |
| 11 | Insect Locomotor Systems /Second Exam | Xiangdong Li |
| 12 | Introduction to plant pathology | Jun Liu |
| 13 | Plant basal defense | Jun Liu |
| 14 | Plant innate immunity I | Jun Liu |
| 15 | Plant innate immunity II | Jun Liu |
| 16 | Plant epidemiology | Jun Liu |
| 17 | Disease management and plant protection/Third Exam | Jun Liu |
| Total |  | 51 |

**Textbook and any related course material:**

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

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

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

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

**Course title**

**Biochemistry**

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

*Prof. ZHONG Liangwei and Professor ZHANG zhuqing*

**Course type:**

*Lectures* *and project works*

**Course Assessment:**

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

**Grading Policy:**

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

**Course Prerequisites:**

*A knowledge on organic chemistry.*

**Catalog Description:**

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

**Content**

The course is divided into the following parts:

Introduction to Biochemistry (Professor ZHONG liangwei)

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

A1. Amino acids and proteins

A2. Structures and functions of proteins

A3. Purification of proteins

Section B – Enzymes (Professor ZHONG Liangwei)

B1. Properties of enzymes

B2. Factors affecting enzyme activity

B3. Enzyme kinetics and inhibition

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

 C1. Protein synthesis

 C2. Protein targeting

 C3. Protein modifications

C4. Protein folding and protein structure prediction (Associate Professor ZHANG zhuqing)

 C5. Protein design and structure-based drug design (Associate Professor ZHANG zhuqing)

Section D – Carbohydrate metabolism (Professor ZHONG Liangwei)

 D1. Basic properties of carbohydrates

 D2. Metabolic pathways

 D3. Digestion and absorption

 D4. High glucose and oxidative stress

Section E – Lipid metabolism (Professor ZHONG Liangwei)

E1. Structure and roles of fatty acids

E2. Fatty acid breakdown and synthesis

E3. Cholesterol metabolism

E4. Lipoproteins

Section F – Nitrogen metabolism (Professor ZHONG Liangwei)

F1. Nitrogen fixation and assimilation

F2. Amino acid metabolism

F3. Urea cycle

Section G — Electron Transport and Oxidative Phosphorylation (Professor ZHONG Liangwei)

G1. The electron transport chains

G2. Oxidative phosphorylation.

**Teaching methods**

* The teaching includes lectures and project works.
* Project works encourage intensive reading of literatures, giving an oral presentation.

**Suggested Textbook, References, and Link**

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

**Course title**

**Conservation Biology**

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

*Prof. JIANG Zhigang and Associate Professor LIU Xuecong*

**Course type:**

*Lecture*

**Course Schedule:**

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

**Course Assessment:**

*Homework: 3 assignments*

**Grading Policy:**

*30% homework, 70% final.*

**Course Prerequisites:**

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

**Catalog Description:**

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

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

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

 |

**Contents of the course**

**Lecture 1:** History of Conservation

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

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

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

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

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

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

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

**Lecture 5** Biodiversity in China

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

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

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

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

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

**Lecture 8:** Ex-situ Conservation

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

**Lecture 9:** Protected Areas

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

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

**Textbook and any related course material:**

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

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

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

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

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

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

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

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

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

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

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

*Video BBC Wild China*

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

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

**Course title**

**Vector and human pathogen**

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

*Prof. Aihua Zheng*

*Prof. Xiangjiang Zhan*

*Prof. Zhen Zou*

**Course type:**

*Lecture*

**Course Assessment:**

*mini-tests in each section*

**Grading Policy:**

*mini-tests scores*

**Course Prerequisites:**

*Without*

**Catalog Description:**

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

**Schedule of the course**

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

**Textbook and any related course material:**

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

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

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

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

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

**Course title**

**Introduction to Epigenetics and RNA silencing**

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

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

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

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

**Teaching assistant:**

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

**Course type:**

*Lecture*

**Course Assessment:**

*mini-tests in each section*

**Grading Policy:**

*mini-tests scores*

**Course Prerequisites:**

*Without*

**Catalog Description:**

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

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

**Schedule of the course**

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

**Textbook and any related course material:**

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

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

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

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

**Course title**

**Nanobiological Sensing and Detection**

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

*Prof. Lele Li*

**Course type:**

*Lecture*

**Course Assessment:**

*Homework: 7 assignments*

**Grading Policy:**

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

**Course Prerequisites:**

*College Chemistry, College Materials, English.*

**Catalog Description:**

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

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

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

 |

**Textbook and any related course material:**

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

**Course title**

**Nanotechnology for Solar Energy Utilization Applications**

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

*Prof. HE Tao*

**Course type:**

*Lecture*

**Course Assessment:**

*Four assignments: Exercise & Presentation*

**Grading Policy:**

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

**Course Prerequisites:**

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

**Catalog Description:**

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

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

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

 |

**Textbook and related documents:**

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

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

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

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

**Course title**

**Nano Electronic Materials**

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

*Prof. XIE Liming*

**Course type:**

*Lecture*

**Course Assessment:**

*Homework: 10 assignments*

**Grading Policy:**

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

**Course Prerequisites:**

*Solid state physics, physical chemistry*

**Catalog Description:**

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

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |
| --- | --- | --- |
| section | content | hours |
| 1 | Motivation and surface effect | 4 |
| 2 | Quantum confinement effect | 4 |
| 3 | Synthesis methods of nano electronic materials | 4 |
| 4 | Characterization methods | 4 |
| 5 | Characterization methods | 4 |
| 6 | Device fabrication techniques | 4 |
| 7 | Electrical measurement | 4 |
| 8 | Quantum dots | 3 |
| 9 | Nanowires | 3 |
| 10 | Carbon nanotubes | 3 |
| 11 | Graphene | 3 |
| 12 | Transition-metal dichalcogenides and Other 2D materials | 3 |
| 13 | Presentation skills and discussion | 3 |
| 14 | Presentations by students | 3 |
| 15 | Presentations by students | 3 |
| total |  | 52 |

 |

**Textbook and any related course materials:**

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

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

*Mathematics: strong*

*Physics: strong*

*Chemistry: strong*

**Course title**

**Plate Tectonics and Evolution of Tibetan Plateau**

**Instructor(s):**

*Prof. Lin Ding et al.*

**Course type:**

*Lecture*

**Course type:**

*Lecture*

**Catalog Description:**

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

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

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |
| --- | --- | --- |
| Section | Content | hours |
| 1 | **Plate tectonics and its developing history** 1. Introduction to Plate Tectonics
2. The Structure of the Earth
3. Three Layers
4. Physical Properties
5. Chemical Compositions
6. Continental Drift
7. Principal Observations
8. The Implications
9. Seafloor Spreading
10. Seafloor Topography
11. Age of the Seafloor
12. Oceanic Ridge System
13. Accreting Plate Boundaries
14. [Divergent](http://www.so.com/link?url=http%3A%2F%2Fgeology.com%2Fnsta%2Fdivergent-plate-boundaries.shtml&q=teaching+plate+tectonics&ts=1479720858&t=f3cdf58048db6fe447bc8aeedf1e8ba&src=haosou" \t "_blank)Plate Boundaries
15. [Convergent](http://www.so.com/link?url=http%3A%2F%2Fgeology.com%2Fnsta%2Fdivergent-plate-boundaries.shtml&q=teaching+plate+tectonics&ts=1479720858&t=f3cdf58048db6fe447bc8aeedf1e8ba&src=haosou" \t "_blank)Plate Boundaries
16. Transform Plate Boundaries
17. Subduction
18. Distribution of Subduction zones
19. Deep Structure of the Subduction Zones
20. Continents
21. The Growth of Continents
22. Continental Margins
23. Hotspots and Mantle Plumes
24. Mantle Convection
25. Surface Volcanisms
26. Deep Origin of Mantle Plumes
27. The Wilson Cycle
28. Traditional Wilson Cycle Model
29. The Implications
30. Planetary Perspective
31. The Early History
32. Comparative Planetary
 | 12 |
| 2 | **Petrology and Plate Tectonics**1. Introduction to Petrology and Plate Tectonics1.1 Material composition of the Earth: -the Earth’s interior (Crust, Mantle and Core; five principal mechanical subdivisions: Lithosphere, Asthenosphere, Mesosphere, Outer core, Inner core);-the Earth’s inorganic chemistry (seven most common elements); -the Earth’s ordered character (common rock-forming minerals).-the Earth’s three main types of rocks (Igneous, Metamorphic, Sedimentary)1.2 What’s the petrology? -Definition (Studying the genesis of the rocks: Igneous petrology, Metamorphic petrology, Sedimentary petrology)-Transformation among the three main types of rocks1.3 Research methods -Field works (Collecting samples/field trip)-Laboratory works (Determination of chemical composition, Dating methods, Thermobarometry methods and others)1.4 Plate Tectonics Review-Plate move evidence-Plate boundaries1.5 Rocks in plate boundaries-Diverging boundaries (e.g. mid-ocean ridges)-Convergent boundaries (e.g. subduction zone)1.6 Rocks in inner plate-Ocean basin-Continental basin2. Igneous Petrology2.1 Fundamental concepts -magma/melts, fractional crystallization, eruption, emplacement, intrusive rocks, volcanic rocks, volcano, dike, country rocks2.2 Common rocks -granite, andesite, basalt 2.3 Magma Generation-composition, temperature, pressure and fluids-partial melting of mantle2.4 Magmatism and Plate Tectonics-Mid-Ocean Ridges-Intra-continental Rifts-Island Arcs-Active Continental Margins-Back-Arc Basins-Ocean Island-Miscellaneous-Intra-Continental Activity3. Metamorphic Petrology: 3.1Fundamental concepts-metamorphic rock, metamorphism 3.2 Subduction-related “Paired metamorphic belts” 3.3 P-T-t path and contributions to Plate tectonics4. Sedimentary Petrology:4.1 Fundamental concepts -sedimentary rock, sedimentation, sedimentology, sedimentary facies4.2 Common rocks -mudstone, sandstone, limestone 4.3 “Bouma sequence” and “Galileo’s free fall” 4.4 “Facies” and Palaeoenvironments5. “Ophiolite” 5.1 What’s ophiolite? -a Special Suite of three types of rocks 5.2 Contribution to the Tibetan Plateau  | 12 |
| 3 | **Paleomagnetism and Plate Tectonics**1. Introduction to Geomagnetism
2. Earth Magnetic Field
3. History
4. Study Fields
5. Basic Rock Magnetism
6. Magnetic Properties
7. Magnetic Mineralogy
8. Magnetic Domains
9. Hysteresis
10. Natural Remanent Magnetism (NRM)
11. Sampling, Measurement, Analysis and Field Tests
12. Collection of Paleomagnetic Samples
13. Demagnetization Techniques
14. Display and Bedding-tilt Correction
15. Identification of Ferromagnetic Minerals
16. The Fold Test
17. Synfolding Magnetization
18. Conglomerate Test
19. Reversals Test
20. Baked Contact and Consistency Tests
21. Other Tests
22. Magnetic Reversals and Inclination Shallowing
23. Magnetic Reversals
24. Paleomagnetic Geochronlogy
25. Inclination Shallowing
26. Plate Tectonics and Sea Floor Spreading
27. Plate Tectonic Theory and Paleomagnetism
28. Sea Floor Spreading Hypothesis and Paleomagnetism
29. Paleomagnetic Poles and Paleogeographic Reconstruction
30. Procedure for Pole Determination
31. Types of Poles
32. Sampling of Geomagnetic Secular Variation
33. Paleogeographic Reconstruction
34. Regional Tectonics-Collision and Shortening
35. Evolution of the Tibetan Plateau and Tethys
36. India-Asia Collision Time and Shortening
37. Regional Tectonics-Regional Rotations
38. Rotations of the NE Tibetan Plateau
39. Rotations of the SE Tibetan Plateau
40. Rotations of the Tibetan Plateau
 | 12 |
| 4 | **Fundamentals of geodynamics** 1. A brief introduction on geodynamics 1.1 The deforming earth 1.2 Plate tectonics: what it can tell us? 1.3 What is geodynamics? 1.4 What this course will tell you?2. Stress and strain in solids 2.1 Force and stress 2.2 Stress state in 2D and 3D 2.3 Pressure in the deep interiors of the earth 2.4 Strain 2.5 Measurements of stress and strain3. Elasticity and flexure of the solid earth 3.1 Linear elasticity 3.2 Uniaxial stress and strain 3.3 Plane stress and strain 3.4 Pure and simple shear 3.5 Bending and flexure of plate in two dimensions 3.6 Flexure with basin and mountain tectonics 4. Rock Rheology 4.1 Diffusion creep 4.2 Dislocation creep 4.3 Temperature- and stress-dependent rheology 4.4 Crustal rheology and viscoelasticity 4.5 Mantle convection and plate motions 5. Faulting 5.1 Classification of Faults 5.2 Mohr-circle theory 5.3 Friction on faults 5.4 Anderson theory of faulting 5.5 Coulomb failure criterion and strength envelop 5.6 Earthquake faulting6. Geodynamic remarks of on the Tibetan plateau 6.1 Deformation from plate boundary to plate interior 6.2 Decadal to millennia time-dependent deformation  6.3 Available geodynamic models of the Tibetan plateau | 12 |
| 5 | **Plate Tectonic in Tibet Plateau**1. Introduction of the Tibet plateau
	1. Why is the Himalayan-Tibetan orogen so wide?
	2. Why is the Tibetan Plateau so flat?
	3. Why are the boundarys so steep?
	4. Why is the Tibetan plateau just so high and no higher?
2. The process of Gondwana split and the Asian continent aggregation
	1. The Gondwana super continent
	2. The split of the Gondwana
	3. The suture zones and aggregation in Tibet
3. India and Eurasia collision
	1. Methods to constrain the initial timing of collision

High Pressure-Ultra High Pressure continental metamorphismOphiolite obductionCessation of marine sedimentationMolasse basinMid-ocean ridge spreading rateChange in direction of plate motionStrike slip faultsCrustal deformationApparent polar wander path (APWP)Peripheral foreland basinLeucograniteMagmatic transition from oceanic to continental subductionFaunal migrationNumerical and physical simulations* 1. History of research on the initial timing of Indian and Asian collision
	2. Deformation of the northern THS in the early collisional stage
	3. Foreland basin system
	4. Collision patterns and suturing processes between the Indian and Asian continents
1. The Raising of Tibet plateau
	1. Index of paleoelevation
	2. The raising of Himalaya
	3. The raising of Tibet
 | 8 |
| 5 | Exam of Oral Presentation: I EXPECT you to be creative and raise novel. | 4 |
| Total |  | 60 |

 |

**Course title**

**Physical Geography**

**Instructor(s):**

*Prof. XiaoMin Fang et al.*

**Course type:**

*Lecture*

**Catalog Description:**

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

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| Section | Content |
| 1 | **Introduction of Physical Geography**1.1 Brief introduction1.2 The earth and its rotation1.3 Coordination system1.4 The earth in the solar system |
| 2 | **Global Energy Balance** 2.1 Insolation to the earth2.2 Global energy system2.3 Energy redistribution and climate change  |
| 3 | **Air Temperature, Moisture and Precipitation**3.1 Air temperature and vertical temperature structure3.2Temperature change3.3 Moisture and humidity3.4 Precipitation formation and types |
| 4 | **Global Climates and Climate Change**4.1 Climate and classification 4.2 Climate with latitude4.3 Climate change and causes4.4 Climate change impacts |
| 5 | **Winds and Global Circulation**5.1 Air pressure, wind and cyclones-anticyclones5.2 Wind circulation5.3 Ocean circulation |
| 6 | **Weather Systems**6.1 Air masses and fronts6.2 Midlatitude anticyclones an cyclones6.3 Tropic and equatorial weather systems |
| 7 | **Earth materials**7.1 The structure of the earth7.2 Earth materials and rocks |
| 8 | **Tectonics and Landforms**8.1 Plate tectonics and global topography 8.2 Tectonic landforms8.2 Volcanic activity and landforms |
| 9 | **Weathering and Mass Wasting**9.1 Weathering 9.2 Mass Wasting**Freshwater of the Continents**10.1 Hydrologic Cycle10.2 Groundwater |
| 10 | 10.3 Streamflow10.4 Lakes10.5 Hydrological Model10.6 Water as a Natural Resource |
| 11 | **Landforms Made by Running Water**11.1 Erosion, Transportation, and Deposition11.2 Stream Gradation and Evolution11.3 Fluvial Landforms11.4 Fluvial Processes in an Arid Climate |
| 12 | **Global Biogeography and Biogeographic Process**12.1 Global Natural Vegetation and Climatic Belts12.2 Terrestrial Ecosystem-Components, structure and function12.3 Energy and Matter Flow in Ecosystem12.4 Biodiversity12.5 Human Disturbance to Natural Ecosystem12.6 Methods of Ecosystem Studies |
| 13 | **Global Soils**13.1 The Nature of the Soil13.2 Soil Chemistry13.3 Soil Moisture13.4 Soil Development13.5 The Global Scope of Soils |
| 14 | **Landforms Made by Wave and Wind**14.1 The Work of Waves and Tides14.2 Coastal Landforms14.3 Wind Action14.4 Eolian Landforms |
| 15 | **Glacial and Periglacial Landforms**15.1 Glaciers and Their Types15.2 Glacial Processes and Their Landforms15.3 Periglacial Processes and Landforms15.4 Glaciations and Climatic Changes |

 |

**Course title**

**Global Change Ecology**

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

*Prof. WANG Tao et al.*

**Course type:**

*Lecture*

**Grading Policy:**

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

*- Participation (30% of grade)*

*- Report (70% of grade)*

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

**Course Prerequisites:**

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

**Catalog Description:**

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

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |
| --- | --- | --- |
| Section | Content | hours |
| 1 | **Introduction of global change ecology** | 4 |
| 2 | **Plant ecophysiological response**2.1 Concepts 2.2 Methods - controlled experiment and stable isotope record2.3 Responses to elevated CO2 and nitrogen availability2.4 Responses to warming and drought2.5 Impacts of multiple factors and their interaction | 8 |
| 3 | **Responses of terrestrial ecosystems**3.1 Forests3.1.1 Cambial activity and wood structure of trees3.1.2 Elevational and latitudinal distribution of forests3.1.3 Global change and forest growth3.2 Grasslands3.2.1 Plant phenology3.2.2 Plant composition and diversity3.2.3 Plant production and decomposition3.2.4 Greenhouse gas fluxes3.2.5 Carbon sequestration3.3 micro-organisms3.3.1 The origin and evolution of microorganims3.3.2 Classification of microorganims3.3.3 The role of microorganims in the response of terrestrial ecosystems to climate change3.3.4 Methods: controlled microcosms experiments and field investigation3.3.5 Methods to study the microbial ecology3.3.6 Responses to warming, precipitation and drought3.3.7 Responses to eCO2 and N availability (GeoChip or high throughput seq) | 24 |
| 4 | **Regional and global responses**4.1 Approaches: Satellite observations4.2 Approaches: Land surface modeling4.3 Terrestrial vegetation dynamics4.4 Carbon cycle4.5 Nitrogen cycle | 20 |
| 5 | **Mitigation and adaption**5.1 Concepts 5.2 Land use and reduce of GHG emissions5.3 Accounting methodology of GHG reduction and monitoring5.4 Carbon trade | 4 |
| Total |  | 60 |

 |

**Course title**

**Climate Change**

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

*Prof. Dr.MA Yaoming*

**Course type:**

*Lecture*

**Catalog Description:**

*Climate Change 2021 spring semester is designed as an introductory course plus our research aspect in ITPCAS (Institute of Tibetan Plateau, Chinese Academy of Sciences) in the* ***Climate Change*** *for graduate students majored in Earth Sciences. This class is a synthesis of current knowledge of the climate system and past and present climates. It provides solid background information and includes critical assessments of issues that remain incompletely understood. There, it is up to the students to logically evaluate climate change issues presented daily by the media. This class will introduce related reference for climate researchers and students, especially for issues of climate change in Earth system. The class presents the basics surrounding climate change in a simple way while pointing out the complexity of climate data collection, processing, and interpretation. Our research aspect in ITPCAS will introduce climate change related topics, for example, land surface heat flux retrieves from in-situ data, satellite remote sensing data and numerical model; land surface model development and data assimilation; black carbon in the mountain glacier area; hydrological model and so on. All of these topics will enhance our theoretical questions about climate change, especially in the Tibetan Plateau.*

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

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |
| --- | --- | --- |
| Section | Content | hours |
| 1 Prof. Yaoming Ma | **Overview of Climate Change**1.1 Weather and climate1.2 What do we mean by climate variability and climate change? 1.3 Connections, timescales and uncertainties 1.4 The big picture | 4 |
| 2 Prof. Yaoming Ma | **Radiation and the Earth’s energy balance**2.1 Solar and terrestrial radiation2.2 Solar variability2.3 Summary | 4 |
| 3 Prof. Yaoming Ma | **The elements of the climate**3.1 The atmosphere and oceans in motion3.2 Atmospheric circulation patterns3.3 Radiation balance3.4 The hydrological cycle3.5 The biosphere3.6 Sustained abnormal weather patterns3.7 Atmosphere–ocean interactions3.8 The Great Ocean Conveyor3.9 Summary | 4 |
| 4 Prof. Baiqing Xu | **Evidence of climate change**8.1 Peering into the abyss of time8.2 From greenhouse to icehouse8.3 Sea-level fluctuations8.4 The ice ages8.5 The end of the last ice age8.6 The Holocene climatic optimum8.7 Changes during times of recorded history8.8 The medieval climatic optimum8.9 The Little Ice Age8.10 The twentieth-century warming8.11 Concluding observations | 4 |
| 5 Prof. Baiqing Xu | **The natural causes of climate change**6.1 Auto-variance and non-linearity6.2 Atmosphere–ocean interactions6.3 Ocean currents6.4 Volcanoes6.5 Sunspots and solar activity6.6 Tidal forces6.7 Orbital variations6.8 Continental drift6.9 Changes in atmospheric composition6.10 A belch from the deep6.11 Catastrophes and the ‘nuclear winter’6.12 Summary | 4 |
| 6 Prof. Baiqing Xu | **Human activities**7.1 Greenhouse gas emissions7.2 Dust and aerosols7.3 Desertification and deforestation7.4 The ozone hole7.5 Summary | 4 |
| 7 Prof. Lei Wang | **The measurement of climate change**4.1 In situ instrumental observations4.2 Satellite measurements4.3 Re-analysis work4.4 Historical records4.5 Proxy measurements4.6 Dating4.7 Isotope age dating4.8 Summary | 4 |
| 8 Prof. Lei Wang | **Statistics, significance and cycles**5.1 Time series, sampling and harmonic analysis5.2 Noise5.3 Measures of variability and significance5.4 Smoothing5.5 Wavelet analysis5.6 Multidimensional analysis5.7 Summary  | 4 |
| 9 Prof. Lei Wang | **Consequences of climate change**9.1 Geological consequences9.2 Flora and fauna9.3 Mass extinctions9.4 Sea levels, ice sheets and glaciers9.5 Agriculture9.6 The historical implications of climatic variability9.7 Spread of diseases9.8 The economic impact of extreme weather events9.9 Summary | 4 |
| 10 Prof. Yimin Liu | Modeling the climate10.1 Context of climate modeling10.2 Understanding climate change10.3 Climate modeling and weather forecasting10.4 Framework of climate models10.5 Climate model development | 4 |
| 11 Prof. Yimin Liu | Climate Modeling, Projection and Uncertainties11.1 Coupled Model Inter-comparison Project (CMIP)11.2 Climate ensemble11.3 Modeling historical climate change11.4 Future climate projection11.5 Modeling biases and uncertainties11.6 Improving climate modeling over the TP11.7 TP cold bias and Asian summer monsoon Simulation | 4 |
| 12 Prof. Yimin Liu | Role of the modelling on scientific understanding I monsoon climatology12.1 The concept of the monsoon thermal adaptation 12.2 Thermal adaptation 12.3 Impact of Land-sea distribution12.4 Impact of Tibetan Plateau & Iranian Plateau12.5 Thermal impacts or dynamic (isolation) impacts? | 4 |
| 13 Prof. Yimin Liu | Role of the modelling on scientific understanding II monsoon variability13.1 Biweekly oscillation of the South Asian Anticyclone13.2 Impact of tropical cyclone on the seasonal evolution of the Asian summer monsoon13.3 Decadal change of East Asian summer monsoon and the Tibetan Plateau impact | 4 |
| 14 Prof. Lei Wang | Hydrological modelling and its applications for integrated water resources management | 4 |
| 15 Prof. Baiqing Xu | Back carbon in the glacier area | 4 |
| 16 Prof. Yaoming Ma | Land surface heat flux retrieve from in-situ data, remote sensing data and numerical model | 4 |
| Total |  | 64 |

 |
|  |

**Course title**

**Chemical Reaction Engineering**

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

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

**Course type:**

*Lecture*

**Course Assessment:**

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

**Grading Policy:**

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

**Course Prerequisites:**

*College Chemistry, College Mathematics, English.*

**Catalog Description:**

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

**Schedule of the course 20×3**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

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

 |

**Textbook and any related course material:**

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

**Course title**

**Energy Chemistry and Energy Chemical Industry**

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

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

**Course type:**

*Lecture*

**Course Assessment:**

*Homework: 10 assignments*

**Grading Policy:**

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

**Course Prerequisites:**

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

**Catalog Description:**

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

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

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

 |

**Textbook and any related course material:**

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

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

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

**Course title**

**Green Chemistry and Engineering**

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

*Prof. Zhang, Guangjin,*

**Course type:**

*Lecture*

**Course Assessment:**

*Homework: 10 assignments, presentations*

**Grading Policy:**

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

**Course Prerequisites:**

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

**Catalog Description:**

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

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

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

 |

**Textbook and any related course material:**

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

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

**Course title**

**Fluidization and Multiphase Flow**

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

*Prof. WANG Wei*

**Course type:**

*Lecture*

**Course Assessment:**

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

**Grading Policy:**

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

**Course Prerequisites:**

*Principle of Chemical Engineering*

**Catalog Description:**

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

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

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

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

 |

**Textbook and any related course material:**

*The textbook mainly refers to:*

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

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

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

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

**Course title**

**Applied Statistics**

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

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

**Course type:**

*Lecture*

**Grading Policy:**

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

**Catalog Description:**

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

**Textbook and any related course material:**

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

**Course title**

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

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

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

**Course type:**

*Lecture*

**Course Schedule:**

*8hrs/week by instructor.*

**Course Assessment:**

*Homework: 4 assignments*

**Grading Policy:**

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

**Course Prerequisites:**

*Remote Sensing, Climate Change, Land Science*

**Catalog Description:**

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

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |  |
| --- | --- | --- | --- |
| section | content | hours | Instructor |
| 1 | **Course Introduction, Introductory Lecture** Concepts, principle | 4 | Youcun Qi |
| 2 | **Basic of Remote Sensing** Major Sensors for monitoring climate changeMajor Sensors for monitoring land use changeMajor Sensors for monitoring severe weather | 8 | Youcun QiJie Cao |
| 3 | **Basic of Remote Sensing** Fundamentals in Satellite imagery and severe weather, Basic information of radiances measured by satellites and its relationship with atmospheric dynamics  | 4 | Jie Cao |
| 4 | **Methods of data processing and analyses**Remote sensing data processingData visualization | 4 | Youcun Qi |
| 5 | **Methods of data processing and analyses**Land classification methodsMachine learning, etc. | 4 | Jinwei Dong |
| 6 | **Methods of data processing and analyses**Interpreting satellite water vapor imagerySevere weather analyses | 4 | Jie Cao |
| 7 | **Student presentation on applications of RS** | 4 | Youcun Qi |
| 8 | **Remote Sensing of Climate Change**Generating the remote sensing dataRainfall detection, Snow coverage and depth detectionExisting climate data and the applicationsData collection and Accuracy Assessment | 4 | Youcun Qi |
| 9 | **Remote Sensing of Climate Change**Rainfall types and changes,Snow coverage and depth monitoring  | 4 | Youcun Qi |
| 10 | **Remote Sensing of Land use change**Existing land use maps and the applicationsLand use mapping and change detectionField Data Collection (Google Earth, Field Photos, and Visual Interpretation of images). Agricultural land use changeForest changes monitoring | 4 | Jinwei Dong |
| 11 | **Remote Sensing of Severe weather**Water vapor imagery analysis of main ingredients of severe weather situations | 4 | Jie Cao |
| 12 | **Remote Sensing of Severe weather**Use of water vapor imagery for assessing numerical climate prediction model behavior and improving forecasts | 4 | Jie Cao |
| 13 | **Presentation of the Final project** | 4 | Youcun QiJie Cao |
| 14 | **Office hour****Final Exam** | 22 | Youcun Qi |
| total |  | 60 |  |

 |

**Contents of the course**

**Section 1: Basic of Remote Sensing**

1. Electromagnetic Radiation Principles
2. Elements of Visual Image Interpretation
3. Multispectral Remote Sensing Systems
4. Hyperspectral Remote Sensing Systems
5. Thermal Remote Sensing Systems
6. Active and Passive Microwave Remote Sensing
7. Basic of Remote Sensing for climate change
8. Major Sensors for monitoring climate change
9. Basic of Remote Sensing for land use change
10. Major Sensors for monitoring land use change
11. Fundamentals in Satellite imagery
12. Basic of satellite imagery in analyzing and predicting severe weather

**Section 2: Methods of data processing and analyses**

1. Methods of data processing and analyses
2. Data processing
3. Data visualization
4. Land classification methods
5. Machine learning, etc.
6. Interpreting satellite water vapor imagery
7. Severe weather analyses

**Section 3: Remote Sensing of Climate Change**

1. Generating the remote sensing data
2. Existing climate data and the applications
3. Data collection (Satellite, GPM, DPR)
4. Accuracy Assessment
5. Rainfall types and changes
6. Snow coverage and depth monitoring

**Section 4: Remote Sensing of Land Use Change**

1. Existing land use maps and the applications
2. Field Data Collection (Google Earth, Field Photos, and Visual Interpretation of images)
3. Land use mapping and change detection
4. Accuracy Assessment
5. Agricultural land use change
6. Forest changes monitoring

**Section 5: Remote Sensing of Severe Weather**

1. Interpretation of light and dark imagery features in satellite water vapor imagery
2. Potential vorticity thinking in severe weather
3. Operational use of the relationship between potential vorticity fields and water vapor imagery
4. Water vapor imagery analysis of main ingredients of severe weather situations
5. Use of water vapor imagery for assessing numerical climate prediction model behavior and improving forecasts

**Textbook and any related course material:**

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

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

*3, Five journal papers will be assigned for student’s individual research project.*

*Students can find these papers from the list we provide or through the Web of Science.*

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

*Prior to taking this course, students need to have basic GIS and imagery process skills, the final project will require quantitative problem solving skills and might entail working with small datasets.*

**Course title**

**Water Chemistry**

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

*Asso. Prof. Huiyu DONG, Prof. Chao LIU, & Asso. Prof. Mengkai LI*

**Course type:**

*Lecture*

**Course Schedule:**

*6hrs/week by instructor*

**Course Assessment:**

*Homework: 5 assignments*

**Grading Policy:**

*Typically 25% homework, 25% presentation, 50% final.*

**Course Prerequisites:**

*General Chemistry, Physical Chemistry*

**Catalog Description:**

*Water Chemistry is a core course in the Environmental Science and Engineering program. It provides a thorough understanding of the fundamentals of water chemistry to our incoming cohorts of students. This course details the quantitative treatment of chemical processes in aquatic systems such as lakes, oceans, rivers, estuaries, groundwaters, and wastewaters. It includes a brief review of chemical thermodynamics that is followed by discussion of acid-base, precipitation-dissolution, coordination, and reduction-oxidation reactions. Emphasis is on equilibrium calculations as a tool for understanding the variables that govern the chemical composition of aquatic systems and the fate of inorganic pollutants.*

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

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

 |

**Contents of the course**

**Part 1: Review of Thermodynamics, and Setting Up and Solving Equilibrium Problems**

1. Introduction, Review of Laws of Thermodynamics
2. Gibbs Free Energy, Chemical Potential, eq. Constants
3. Setting Up Equilibrium Problems - Tableau Method Molecular beam epitaxy
4. Solving Problems by Approximation - Log C vs. pH Diagrams
5. Temperature, Pressure, and Ionic Strength Effects on Equilibrium
6. Properties of Water, Interactions Among Solutes, Activity Coefficients
7. Activity Coefficients and Debye-Huckel Theory

**Part 2: Acid-base Chemistry of Natural Waters**

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

**Part 3: Dissolution, Precipitation, and Complexation**

1. Mineral Solubility
2. Stability Diagrams
3. Chemical Weathering and Natural Water Composition
4. Trace Metals - Inorganic Complexation

**Part 4: Redox Chemistry**

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

**Part 5: Chemical Kinetics**

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

**Textbook and any related course material:**

*Mark Benjamin, Water Chemistry, Second Edition*

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

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

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

*Mathematics: strong*

*Chemistry: strong*

**Course title**

**Fundamental for Internet of Things and Its Applications**

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

*Prof. Weidong Yi*

**Course type:**

*Lecture*

**Course Schedule:**

*3hrs/week by instructor. 1 hr/week by teaching assistant.*

**Course Assessment:**

*Homework: 6 assignments*

**Grading Policy:**

*Typically 30% homework, 40% final exam, 30% final project*

**Course Prerequisites:**

*None*

**Catalog Description:**

*This course provides an introduction to the fundamental concepts and principles of internet of things (IoT)and a survey of its applications at different areas. The course is broken into four parts. In Part One, Introduction, which provides an overview of IoT applications, sensor nodes, and basic system structure,different node architectures and discusses in detail the sensing and processing subsystems as well as communication interfaces. Part Two, Basic Architectural Framework, which provides a detailed discussion of protocols and algorithms used at different network protocol layers in sensor systems. Part Three, Node and Network Management, which discusses several additional techniques and presents solutions for a variety of challenges, including power management techniques, concept of time synchronization and an overview of several synchronization strategies, a variety of localization strategies and compares their trade-offs. Security challenges and defenses against attacks on sensor networks of IoT are discussed in the part. Part Four, Applications, which provides cases study for applications in IoT, including applications for environmental monitoring , structure health monitoring, traffic control, precision agriculture, smart city , smart health-care etc.*

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |
| --- | --- | --- |
| section | content | hours |
| 1 | Motivation for an Internet of Things  | 8 |
| 2 | Node Architecture of IoT | 8 |
| 3 | Operating System for IoT | 8 |
| 4 | Physical Layer | 4 |
| 5 |  Medium Access Control | 4 |
| 6 |  Network Layer | 4 |
| 7 | Power Management | 4 |
| 8 | Time Synchronization | 4 |
| 9 | Localization | 4 |
| 10 | Security | 4 |
| 11 | Applications | 4 |
| 12 | Student presentation | 2 |
| 13 | Final Exam | 2 |
| total |  | 60 |

 |

**Contents of the course**

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

**Textbook and any related course material:**

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

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

None

**Course title:**

**Biodiversity science**

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

*Prof. MA Keping*

**Course type:**

*Lecture*

**Course Schedule:**

*4hrs/week by instructor*

**Course Assessment:**

*Homework: 10 assignments*

**Grading Policy:**

*Typically 40% homework, 60% final.*

**Course Prerequisites:**

*Ecology, General biology, Biogeography*

**Catalog Description:**

*This course includes 14 sections:*

1. Introduction
	1. history of biodiversity science, conservation ecology and conservation biology
	2. 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
 | 2 |
| 2 | Biodiversity status and conservation strategies | 4 |
| 3 | Biodiversity distribution pattern and associated environmental factors | 4 |
| 4 | Species distribution model and its applications | 4 |
| 5 | Biodiversity maintenance mechanisms | 4 |
| 6 | Biodiversity and ecosystem function and services | 2 |
| 7 | Biodiversity monitoring and community assembly | 2 |
| 8 | Student presentation | 2 |
| 9 | Biodiversity informatics and big data science | 4 |
| 10 | Biodiversity mapping and conservation priority areas | 4 |
| 11 | Indicators and surrogates for biodiversity | 2 |
| 12 | Climate and biodiversity | 4 |
| 13 | Biodiversity hotspots and conservation planning | 4 |
| 14 | On site and off site conservation | 4 |
| 15 | Global efforts in biodiversity conservation | 2 |
| 16 | Final exam | 2 |
| total |  | 50 |

 |

**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](https://www.amazon.com/-/zh/Mark-V-Lomolino/e/B001KIXG4I/ref%3Ddp_byline_cont_book_1), [Brett R. Riddle](https://www.amazon.com/-/zh/Brett-R-Riddle/e/B07JHFMLZY/ref%3Ddp_byline_cont_book_2), [Robert J. Whittaker](https://www.amazon.com/-/zh/Robert-J-Whittaker/e/B07JJ35DDP/ref%3Ddp_byline_cont_book_3), [James H. Brown](https://www.amazon.com/-/zh/James-H-Brown/e/B001IZ19VU/ref%3Ddp_byline_cont_book_4). 2010. Biogeography. Oxford University Press

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

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

*General biology: moderate*

*Ecology: moderate*

*Biogeography: moderate*

**Course title**

**Development Geography**

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

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

**Course type:**

*Lecture*

**Course Schedule:**

*3hrs/week by instructor*

**Course Assessment:**

*Homework: 4 assignments；student presentation*

**Grading Policy:**

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

**Course Prerequisites:**

*NULL*

**Catalog Description:**

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

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |
| --- | --- | --- |
| Section | Content | Hours |
| 1 | Concepts and progress of development geography | 3 |
| 2 | Overview of development geography | 3 |
| 3 | Overview of geographical differences in regional development geography | 6 |
| 4 | Income inequality and poverty | 3 |
| 5 | Geographical distribution of population in China | 3 |
| 6 | Land use policy and management in China | 3 |
| 7 | Agriculture and food security in China | 3 |
| 8 | Student presentation and discussions | 3 |
| 9 | Resource and environmental carrying capacity and regional differences | 6 |
| 10 | Geographic development differences in rural areas and agriculture | 3 |
| 11 | Geographic development differences in cities and industry | 3 |
| 12 | Student presentation and discussions | 3 |
| 13 | Review on globalization and regionalization development | 3 |
| 14 | International trade, cooperation and regional development | 3 |
| 15 | The balance of payments, financial stability and regional development | 3 |
| 16 | The national cases: China, Brazil and India | 3 |
| 17 | Student presentation and discussions | 3 |
| 18 | Exam | 3 |
| Total |  | 60 |

 |

**Contents of the course**

**Section 1: Understanding Development Geography**

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

**Section 2: Social and Economic Development**

1. Income inequality and poverty
2. Fundamentals of income inequality and poverty
3. Measurement and representation of income inequality
4. Measurement and representation of poverty
5. Policies to address income inequality and poverty
6. Geographical distribution of population in China
7. Characteristics of population growth
8. Characteristics of population structure
9. Spatial and geographical distribution of population
10. Population growth and migration policy
11. Land use policy and management in China
12. Evolution of land use policies in China
13. Effectiveness and impacts of major land use policies in China
14. Discussion on land system reform
15. Agriculture and food security in China
16. Role of agriculture and food security
17. Spatial distribution of agricultural production and regional difference
18. Reform of agricultural policies

**Section 3: Environmental and Rural-Urban Development**

1. Resource and environmental carrying capacity and regional differences
2. The effect of environmental protection and ecological civilization construction on geographical development
3. Measurement and characterization of environmental capacity and resources and environmental carrying capacity
4. Measurement and characterization of ecological development efficiency
5. Research on the convergence of regional economic development
6. Ecological civilization construction and sustainable development strategic spatial layout
7. Transformation path and policy choices in underdeveloped areas
8. Geographic development differences in rural areas and agriculture
9. The role of cities and industry in geographic development
10. Urbanization process and spatial distribution differences
11. Industrial development status and spatial distribution differences
12. Urbanization development and industrial reform policies
13. Geographic development differences in cities and industry
14. The role of cities and industry in geographic development
15. Urbanization process and spatial distribution differences
16. Industrial development status and spatial distribution differences
17. Urbanization development and industrial reform policies

**Section 4: Globalization, trade and regional development**

1. Review on globalization and regionalization development
2. Role of globalization on geography development
3. Current international geographical differences
4. Status of China in the globalization process
5. Policy choice of developing countries in the process of globalization
6. International trade, cooperation and regional development
7. Theory of international trade for the development of the geographical environment
8. International cooperation organizations and institutions
9. Geopolitics and protectionism
10. Trade policy comparison between countries
11. The balance of payments, financial stability and regional development
12. International financial stability for the role of regional development
13. Balance of payments deficit and trade war
14. Effects of the global financial crisis on developing countries
15. Financial system reform and promoting the development of regional policy
16. The national cases: China, Brazil and India
17. National development in the future
18. China's development present situation and the future
19. Brazil's development present situation and the future
20. India's development present situation and the future

**Textbook and any related course material:**

*Hodder, R. (2000). Development Geography. Psychology Press.*

*Potter, R., Conway, D., Evans, R., & Lloyd-Evans, S. (2012). Key Concepts in Development Geography. Sage Publications.*

*Lawson, V. (2014). Making Development Geography. Routledge.*

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

*Geography: Medium*

*Economics: Primary*

**Course title**

**Integrative Systematic Biology**

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

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

**Course type:**

*Lecture*

**Course Schedule:**

*4hrs/week by instructor.*

**Course Assessment:**

*Homework: 12 assignments*

**Grading Policy:**

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

**Course Prerequisites:**

*Basic knowledge in general biology and molecular biology.*

**Catalog Description:**

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

**Schedule of the course**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |  |  |
| --- | --- | --- | --- |
| Section | Content | hours | Lecturer |
| 1 | Systematics foundations  | 3 | CDZ |
| 2 | Molecular Systematics | 3 | CDZ |
| 3 | Integrative Systematics | 3 | CDZ |
| 4 | Models and Methods in Systematics | 3 | ARL |
| 5 | Phylogenomics (2 hrs)Demo session: Sequence Analysis Pipeline (1 hr) | 3 | ARL |
| 6 | Student Presentation | 3 | DC |
| 7 | Molecular Ecology  | 3 | DC |
| 8 | Applied DNA Barcoding | 3 | DC |
| 09 | Phylogeography and Conservation | 3 | MCO,DC |
| 10 | Demo Session; Phylogenetic Community Ecology | 3 | DC |
| 11 | Student Presentation | 3 | DC, MCO |
| 12 | Case Studies across the Tree of Life | 3 | MCO |
| 13 | Molecular Clock and Timescale of the Tree of Life | 3 | ARL |
| 14 | BEAST | 3 | ARL |
| 15 | Integrative Insect Phylogenetics | 3 | CDZ |
| 16 | Lab Tour | 3 | ARL |
| 17 | Exam | 3 | CDZ |
| Total |  | 51 |  |

 |

**Contents of the course**

**Section 1: Foundations of systematic biology**

1. Systematics
2. DNA sequence data in systematics
3. History and principles of molecular systematics
4. Methods; distance, parsimony, maximum likelihood, Bayesian inference; phylogenetics software
5. Phylogenomics
6. Advances in sequencing technology
7. Principles of orthology, marker choice, processing pipelines

**Section 2: Applied molecular sequence analysis**

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

**Section 3: Case studies in integrative systematics**

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

**Textbook and any related course material:**

*David M. Hillis. 1996. Molecular Systematics.*

*Nathan G. Swenson. 2014. Functional and Phylogenetic Ecology in R.*

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

*Biology: strong*

*Mathematics: competent*

**Course title**

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

**Course type:**

*Lecture*

**Grading Policy:**

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

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

**Schedule of the course**

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