COURSE CATALOG

2019-2020 Autumn Semester

International College of UCAS

Yanqihu Campus

Index

General Introduction

1. General Degree Requirements for Doctors

The requirement of UCAS for Doctor Degree is to get at least 8 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.

2. 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.

3. 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	**6 credits**	**≥2 credits**	**≥13 credits**	**≥30 credits**
PhD	**6 credits**	**None**	**≥4 credits and ≥2 courses**	**≥9 credits**
MD-PhD	**12 credits**	**≥2 credits**	**≥16 credits**	**≥38 credits**

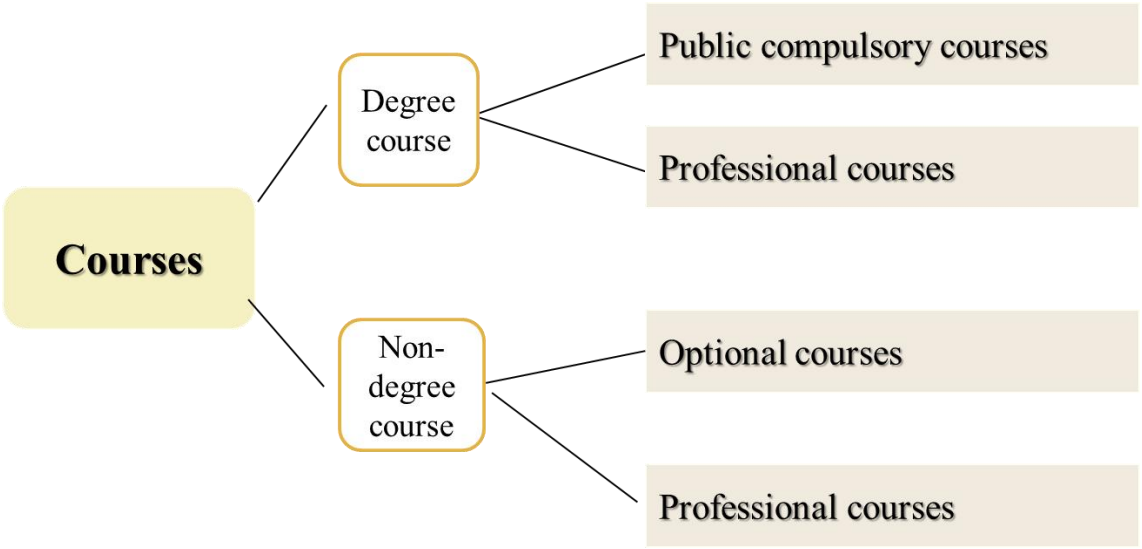
4. Other Requirements for CAS-TWAS fellowship students

1. You need to choose two professional courses and get marks from these courses. One professional course's marks will be calculated as 15% into the PHD Qualification Exam. Two professional courses' will be 30%.
2. These two professional courses can be Degree Courses or Non-Degree Courses, the decision of course classification is left to the supervisor. No matter Degree Course or Non-Degree Course, it will be the same percentage (15%) in the Qualification Exam.
3. If students do not get enough credits in International College, they need to take

more courses when coming back institutes. Please contact your institute first to make sure there are some professional courses for International students.

5. Courses Type

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



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

(1) Elementary Chinese-Reading and Writing (2 credits);
(2) Elementary Chinese-Listening and Speaking (2 credits);
(3) China Panorama (2 credits).

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

A. Providing a certificate of HSK Level 3;
B. Got a bachelor's degree or master's degree which are taught in Chinese.

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

5.2 Professional courses—Degree Courses and Non-degree Courses

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

The professional courses can be classified as one of two types: Degree Courses and Non-degree Courses. This final decision of course classification for each student is left to the supervisor, as s/he is in the best position to assess the courses for the graduate programs. If students find the professional courses are totally not related to his/her major and will not help the research for PhD, then these courses can be seen as Non-degree Courses (Optional Courses). If the professional courses will help the

research for PhD, then they should be Degree Courses (Compulsory Courses). This classification of one course will be shown on the course selection form and the final score sheet. All the students have two weeks to attend the professional classes and choose them.

5.3 Optional courses—Non-degree Courses

This semester we have 4 optional courses, which should be Non-degree courses.

1. MATLAB with Applications to Mathematics, Science, Engineering, and Finance (2 credits);
2. Research Ethics (1 credit);
3. Scientific Writing (2 credits);
4. Public Speaking (2 credits);

6. Rules about courses results

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

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

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

The Language courses and China Panorama are all Degree courses.

7. Course Selection Process

Date	**Process**
Sep.2	Courses start.
Sep.2-Sep.20	Determine which professional courses you will take and select the professional courses in the Course Selection System.
Sep.23-Sep.27	Confirm signature in every professional courses class. (Important)
Dec.31	Courses end.

Vocations: Mid-Autumn Festival lasts from Sep.13th-Sep.15th; National Day lasts from Oct.1st-Oct.7th.

8. Course Selection System

This course selection system is for students registering professional courses online. Students will receive an email from the Course Selection System one week before courses start. Then students will have two weeks to choose the professional courses online and change the courses. Please use the Google Chrome or 360 browsers. Do not choose two courses schedule overlap. After courses starting two weeks, the system will be closed. Then everyone will receive the message for signing in the class to determine the professional courses.

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

Username: Your email (application for the admission)

Original password: 123456

The capacity of every course is limited and first come first select.

9. Transcript

DO NOT apply it from the International College.

There are two ways to get your transcript before graduation.

Method 1: From Your Institute.

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

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

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

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

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

Academic Affair Office Working time（教务部）

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

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

10. Contact Information

Education Coordinator for Professional Courses:

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

Education Coordinator for Language Courses:

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

10. Professional Courses and Optional Courses List

Code	Name	Hours/ Credits	Type	Professors		Time	Classroom	Capacity	Date
0805I0D01001H	Functional Nanostructures: Syntheses, Characterization and Device Application	60/4	Professional course	HE Jun	WEI Zhixiang	Wed.13:30-17:10	Teaching2-227	100	Sep.11-Dec.25,Day-off in Oct.2, 15times
0702I0D01002H	Overview of Recent Development of Physics	48/3	Professional course	ZHOU Yu feng et al.	SHI Xinghua	Thu.13:30-17:10	Teaching1-134	34	Sep.12-Dec.5,Day-off in Oct.3, 12times
0704I0D01001H	Fundamentals of Modern Astronomy	40/2.5	Professional course	GOU Lijun	WANG Lan	Tue.13:30-17:10	Teaching1-232	34	Sep.10-Nov.19,Day-off in Oct.1, 10times
0714I0D01001H	Data Mining	60/4	Professional course	LIU Ying		Mon.13:30-15:10 Wed.13:30-15:10	Teaching1-322	34	Sep.9-Dec.25,Day-off in Oct.1&Oct.7, 30times
0702I0D01001H	Advanced Quantum Mechanics	45/3	Professional course	QIAO Congfeng		Wed.19:00-21:40 Fri.19:00-21:40	Teaching1-127	34	Oct.30-Dec.18, 15times
0703I0M01001H	Organometallic Chemistry-for masters	60/4	Professional course	SUN Wenhua		Mon.13:30-17:10	Teaching1-132	34	Sep.9-Dec.23,Day-off in Oct.7, 15times
0703I0D01001H	Organometallic Chemistry and Catalysis-for doctors	60/4	Professional course	SUN Wenhua		Tue.8:30-12:10	Teaching1-114	100	Sep.10-Dec.24,Day-off in Oct.1, 15times

0710I0D01003H	The Frontier of Genomics and Precision Medicine	60/4	Professional course	SUN Yingli et al.	Wed.13:30-17:10	Teaching1-213	100	Sep.11-Dec.25,Day-off in Oct.2, 15times
0710I0D01002H	Plant Molecular Biology and Genomics	60/4	Professional course	JING Haichun et.al.	Fri.13:30-17:10	Teaching2-125	100	Sep.20-Dec.27,Day-off in Sep.13&Oct.4, 15times
0710I0D01012H	Biophysics and Organelle Biology	40/2.5	Professional course	LIU Pingsheng	Wed.13:30-17:10	Teaching2-319	56	Sep.11-Nov.20,Day-off in Oct.2, 10times
0710I0D01004H	Fundamental Immunology	40/2.5	Professional course	FANG Min DUAN Xuefeng	Tue.8:30-12:10	Teaching1-115	100	Sep.10-Nov.19,Day-off in Oct.1, 10times
0710I0D01005H	Model Animals in Developmental Biology	60/4	Professional course	YUAN Li	Tue.13:30-17:10	Teaching2-418	48	Sep.10-Dec.24,Day-off in Oct.1, 15times
0710I0D01001H	Plant Physiology and Developmental Biology	60/4	Professional course	CHENG Youfa	Mon.13:30-17:10	Teaching1-214	100	Sep.9-Dec.23,Day-off in Oct.7, 15times
0830I0D01003H	Environmental and Natural Resource Economics	60/4	Professional course	DENG Xiangzheng	Tue.8:30-12:10	Teaching1-304	120	Sep.10-Dec.24,Day-off in Oct.1, 15times
0706I0D01002H	Overview of Climate Change Sciences	60/4	Professional course	KANG Shichang et al.	Tue.13:30-17:10	Teaching2-107	134	Sep.10-Dec.24,Day-off in Oct.1, 15times
0708I0D01002H	Earth System Science	60/4	Professional course	CHEN Fang JIA Gensuo	Mon.13:30-17:10	Teaching2-327	100	Sep.9-Dec.23,Day-off in Oct.7, 15times
0708I0D01001H	Introduction to Geodynamics	48/3	Professional course	WANG Shimin	Thu.13:30-17:10	Teaching2-418	58	Sep.12-Dec.5,Day-off in Oct.3, 12times

0805I0D01002H	Materials Production and Environmental Science	60/4	Professional course	DU Hao	Mon.13:30-17:10	Teaching2-427	100	Sep.9-Dec.23,Day-off in Oct.7, 15times
0817I0D01004H	Multiphase Reactor Theory and Analysis	56/4	Professional course	LIU Xiao xing LU Bona	Fri.13:30-17:10	Teaching2-419	58	Sep.6-Dec.20,Day-off in Sep.13&Oct.4, 14times
0830I0D01001H	Environmental Chemistry	60/4	Professional course	TIAN Zhen yu	Tue.8:30-12:10	Teaching1-208	154	Sep.10-Dec.24,Day-off in Oct.1, 15times
0830I0D01002H	Advanced Diagnostic Technologies of Chemical Reactions and Its Application	60/4	Professional course	TIAN Zhen yu	Tue.13:30-17:10	Teaching1-415	45	Sep.10-Dec.24,Day-off in Oct.1, 15times
0705I0D01002H	Remote Sensing Image Processing	52/3.5	Professional course	JIANG Xiaoguang et al.	Tue.13:30-17:10	Study Area3-244	75	Sep.10-Dec.10,Day-off in Oct.1, 13times
0805I0D01003H	Fundamentals and frontier of Materials Science	60/4	Professional course	ZHANG Guangjin et al.	Thu.13:30-17:10	Teaching2-321	58	Sep.12-Dec.26,Day-off in Oct.3, 15times
0705I0D01003H-01	Geographic Information Systems	52/3.5	Professional course	SONG Xianfeng et al.	Wed.13:30-17:10	Study Area3-244	75	Sep.11-Dec.11,Day-off in Oct.2, 13times
0705I0D01003H-02	Geographic Information Systems	52/3.5	Professional course	ZHOU Xiang et al.	Fri.13:30-17:10	Study Area2-216	46	Sep.6-Dec.13,Day-off in Sep.13&Oct.4, 13times

0812I0D01001H	Advanced Software Engineering	60/4	Professional course	LUO Tiejian	Thu.18:00-21:20	Study Area2-102	32	Sep.10-Dec.24,Day-off in Oct.1, 15times
0812I0D01002H	Data Science	60/4	Professional course	LUO Tiejian	Tue.13:30-17:10	Study Area2-102	46	Sep.10-Dec.24,Day-off in Oct.1, 15times
0812I0DGX001H	MATLAB with Applications to Mathematics, Science, Engineering, and Finance	45/2	Optional course	LUO Cuicui	Tue.9:20-12:10	Study Area3-244	75	Sep.10-Dec.24,Day-off in Oct.1, 15times
010105DGX001H-01	Ethics in Scientific Research, Bioethics, & Survival Skills for A Research Career	21/1	Optional course	ZENG Changqing	Fri.13:30-16:20	Teaching2-227	100	Oct.18-Dec.13,Day-off in Oct.4,7times
010105DGX001H-02	Ethics in Scientific Research, Bioethics, & Survival Skills for A Research Career	21/1	Optional course	ZENG Changqing	Fri.19:00-21:40	Teaching2-227	100	Oct.18-Dec.13,Day-off in Oct.4,7times
050200DGX002H-01	Scientific Writing	48/2	Optional course	YU Hua	Thu.13:30-17:10	Teaching2-318	58	Sep.12-Dec.5,Day-off in Oct.3,12times
050200DGX002H-02	Scientific Writing	48/2	Optional course	PENG Gong	Wed.13:30-17:10	Teaching2-219	46	Sep.11-Dec.4,Day-off in Oct.2,12times
050200DGX002H-03	Scientific Writing	48/2	Optional course	HONG Lei	Wed.13:30-17:10	Teaching2-436	46	Sep.11-Dec.4,Day-off in Oct.2,12times
050200DGX002H-04	Scientific Writing	48/2	Optional course	CHEN Nianning	Tue. 8:30-12:10	Teaching2-219	58	Sep.10-Dec.3,Day-off in Oct.1,12times

050200DGX002H-05	Scientific Writing	48/2	Optional course	LIU Yunlong	Thu.13:30-17:10	Teaching2-419	58	Sep.12-Dec.5,Day-off in Oct.3,12times
050200DGX003H	Public Speaking	48/2	Optional course	MENG Yanli	Tue.13:30-17:10	Teaching2-325	58	Oct.8-Dec.24,12times

11. Public Compulsory Courses List

Class No.	Code	Name	Hours/Credits	Time	Classroom	Teachers
Y-1	17DGB001H-1	Elementary Chinese-Reading and Writing	128/2.0	Mon.(8:30-10:10)	Teaching2-238	HE Tao
				Wed.(10:20-12:00)	Teaching2-238	
				Thur.(8:30-10:10)	Teaching2-238	
				Fri.(10:20-12:00)	Teaching2-238	
	17DGB002H-1	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(10:20-12:00)	Teaching2-238	LUO Lei
				Wed.(8:30-10:10)	Teaching2-238	
				Thur.(10:20-12:00)	Teaching2-238	
				Fri.(8:30-10:10)	Teaching2-238	
	17DGB003H-1	China Panorama	48/2.0	Fri.13:30-16:20	Teaching1-317	JIANG Hong'en
Y-2	17DGB001H-2	Elementary Chinese-Reading and Writing	128/2.0	Mon.(10:20-12:00)	Teaching2-318	HE Tao
				Wed.(8:30-10:10)	Teaching2-318	
				Thur.(10:20-12:00)	Teaching2-319	
				Fri.(8:30-10:10)	Teaching2-318	
	17DGB0	Elementary	128/2.0	Mon.(8:30-10:10)	Teaching2-318	LUO Lei

	02H-2	Chinese-Listening and Speaking		Wed.(10:20-12:00)	Teaching2-318	
				Thur.(8:30-10:10)	Teaching2-319	
				Fri.(10:20-12:00)	Teaching2-318	
	17DGB003H-2	China Panorama	48/2.0	Fri.19:00-21:40	Teaching1-317	JIANG Hong'en
Y-3	17DGB001H-3	Elementary Chinese-Reading and Writing	128/2.0	Mon.(8:30-10:10)	Teaching2-321	LIU Xiaomeng
				Wed.(10:20-12:00)	Teaching2-321	
				Thur.(8:30-10:10)	Teaching2-323	
				Fri.(10:20-12:00)	Teaching2-321	
	17DGB002H-3	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(10:20-12:00)	Teaching2-321	YI Zhuo
				Wed.(8:30-10:10)	Teaching2-321	
				Thur.(10:20-12:00)	Teaching2-323	
				Fri.(8:30-10:10)	Teaching2-321	
	17DGB003H-3	China Panorama	48/2.0	Fri.13:30-16:20	Teaching1-409	LUO Wugan
Y-4	17DGB001H-4	Elementary Chinese-Reading and Writing	128/2.0	Mon.(10:20-12:00)	Teaching2-418	LIU Xiaomeng
				Wed.(8:30-10:10)	Teaching2-418	
				Thur.(10:20-12:00)	Teaching2-418	
				Fri.(8:30-10:10)	Teaching2-418	
	17DGB002H-4	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(8:30-10:10)	Teaching2-418	LUO Wei
				Wed.(10:20-12:00)	Teaching2-418	
				Thur.(8:30-10:10)	Teaching2-418	
				Fri.(10:20-12:00)	Teaching2-418	
	17DGB0	China Panorama	48/2.0	Fri.19:00-21:40	Teaching1-409	LUO Wugan

	03H-4					
Y-5	17DGB001H-5	Elementary Chinese-Reading and Writing	128/2.0	Mon.(8:30-10:10)	Teaching2-438	WANG Lei
				Wed.(10:20-12:00)	Teaching2-438	
				Thur.(8:30-10:10)	Teaching2-438	
				Fri.(10:20-12:00)	Teaching2-438	
	17DGB002H-5	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(10:20-12:00)	Teaching2-438	LI Ran
				Wed.(8:30-10:10)	Teaching2-438	
				Thur.(10:20-12:00)	Teaching2-438	
				Fri.(8:30-10:10)	Teaching2-438	
	17DGB003H-5	China Panorama	48/2.0	Fri.13:30-16:20	Teaching2-318	CHU Guofei
Y-6	17DGB001H-6	Elementary Chinese-Reading and Writing	128/2.0	Mon.(10:20-12:00)	Teaching2-436	WANG Lei
				Wed.(8:30-10:10)	Teaching2-436	
				Thur.(10:20-12:00)	Teaching2-436	
				Fri.(8:30-10:10)	Teaching2-436	
	17DGB002H-6	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(8:30-10:10)	Teaching2-436	LI Ran
				Wed.(10:20-12:00)	Teaching2-436	
				Thur.(8:30-10:10)	Teaching2-436	
				Fri.(10:20-12:00)	Teaching2-436	
	17DGB003H-6	China Panorama	48/2.0	Fri.19:00-21:40	Teaching2-318	CHU Guofei
Y-7	17DGB001H-7	Elementary Chinese-Reading and Writing	128/2.0	Mon.(8:30-10:10)	Teaching2-414	QI Xiaodong
				Wed.(10:20-12:00)	Teaching2-414	
				Thur.(8:30-10:10)	Teaching2-414	
				Fri.(10:20-12:00)	Teaching2-414	

	17DGB0 02H-7	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(10:20-12:00)	Teaching2-414	LI Ya
				Wed.(8:30-10:10)	Teaching2-414	
				Thur.(10:20-12:00)	Teaching2-414	
				Fri.(8:30-10:10)	Teaching2-414	
	17DGB0 03H-7	China Panorama	48/2.0	Fri.19:00-21:40	Teaching2-218	CAO Zhihong
Y-8	17DGB0 01H-8	Elementary Chinese-Reading and Writing	128/2.0	Mon.(10:20-12:00)	Teaching2-434	QI Xiaodong
				Wed.(8:30-10:10)	Teaching2-334	
				Thur.(10:20-12:00)	Teaching2-434	
				Fri.(8:30-10:10)	Teaching2-434	
	17DGB0 02H-8	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(8:30-10:10)	Teaching2-434	LI Ya
				Wed.(10:20-12:00)	Teaching2-334	
				Thur.(8:30-10:10)	Teaching2-434	
				Fri.(10:20-12:00)	Teaching2-434	
	17DGB0 03H-8	China Panorama	48/2.0	Mon.19:00-21:40	Teaching2-118	YE Qing
Y-9	17DGB0 01H-9	Elementary Chinese-Reading and Writing	128/2.0	Mon.(8:30-10:10)	Teaching2-313	HE Fei
				Wed.(10:20-12:00)	Teaching2-313	
				Thur.(8:30-10:10)	Teaching2-313	
				Fri.(10:20-12:00)	Teaching2-313	
	17DGB0 02H-9	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(10:20-12:00)	Teaching2-313	LIU Jie
				Wed.(8:30-10:10)	Teaching2-313	
				Thur.(10:20-12:00)	Teaching2-313	
				Fri.(8:30-10:10)	Teaching2-313	
	17DGB0	China Panorama	48/2.0	Mon.19:00-21:40	Teaching2-123	CHEN Tianjia

	03H-9					
Y-10	17DGB0 01H-10	Elementary Chinese-Reading and Writing	128/2.0	Mon.(10:20-12:00)	Teaching2-413	HE Fei
				Wed.(8:30-10:10)	Teaching2-413	
				Thur.(10:20-12:00)	Teaching2-234	
				Fri.(8:30-10:10)	Teaching2-413	
	17DGB0 02H-10	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(8:30-10:10)	Teaching2-413	LI Jia
				Wed.(10:20-12:00)	Teaching2-413	
				Thur.(8:30-10:10)	Teaching2-234	
				Fri.(10:20-12:00)	Teaching2-413	
	17DGB0 03H-10	China Panorama	48/2.0	Thu.13:30-16:20	Teaching2-313	YANG Yimin
Y-11	17DGB0 01H-11	Elementary Chinese-Reading and Writing	128/2.0	Mon.(8:30-10:10)	Teaching2-423	LI Shuangshuang
				Wed.(10:20-12:00)	Teaching2-423	
				Thur.(8:30-10:10)	Teaching2-423	
				Fri.(10:20-12:00)	Teaching2-423	
	17DGB0 02H-11	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(10:20-12:00)	Teaching2-423	XIE Wenjie
				Wed.(8:30-10:10)	Teaching2-423	
				Thur.(10:20-12:00)	Teaching2-423	
				Fri.(8:30-10:10)	Teaching2-423	
	17DGB0 03H-11	China Panorama	48/2.0	Thu.19:00-21:40	Teaching2-313	YANG Yimin
Y-12	17DGB0 01H-12	Elementary Chinese-Reading and Writing	128/2.0	Mon.(10:20-12:00)	Teaching2-419	LI Shuangshuang
				Wed.(8:30-10:10)	Teaching2-419	
				Thur.(10:20-12:00)	Teaching2-419	
				Fri.(8:30-10:10)	Teaching2-419	

	17DGB0 02H-12	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(8:30-10:10)	Teaching2-419	CHEN Ge
				Wed.(10:20-12:00)	Teaching2-419	
				Thur.(8:30-10:10)	Teaching2-419	
				Fri.(10:20-12:00)	Teaching2-419	
	17DGB0 03H-12	China Panorama	48/2.0	Tue.13:30-16:20	Teaching2-313	ZHU Jian
Y-13	17DGB0 01H-13	Elementary Chinese-Reading and Writing	128/2.0	Mon.(8:30-10:10)	Teaching2-338	QI Bo'peng
				Wed.(10:20-12:00)	Teaching2-338	
				Thur.(8:30-10:10)	Teaching2-338	
				Fri.(10:20-12:00)	Teaching2-338	
	17DGB0 02H-13	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(10:20-12:00)	Teaching2-338	ZHANG Dan
				Wed.(8:30-10:10)	Teaching2-338	
				Thur.(10:20-12:00)	Teaching2-338	
				Fri.(8:30-10:10)	Teaching2-338	
	17DGB0 03H-13	China Panorama	48/2.0	Tue.09:20-12:10	Teaching2-314	LAN Li
Y-14	17DGB0 01H-14	Elementary Chinese-Reading and Writing	128/2.0	Mon.(10:20-12:00)	Teaching2-421	QI Bo'peng
				Wed.(8:30-10:10)	Teaching2-123	
				Thur.(10:20-12:00)	Teaching2-123	
				Fri.(8:30-10:10)	Teaching2-123	
	17DGB0 02H-14	Elementary Chinese-Listening and Speaking	128/2.0	Mon.(8:30-10:10)	Teaching2-421	REN Li'yuan
				Wed.(10:20-12:00)	Teaching2-123	
				Thur.(8:30-10:10)	Teaching2-123	
				Fri.(10:20-12:00)	Teaching2-123	
	17DGB0	China Panorama	48/2.0	Tue.13:30-16:20	Teaching2-314	LAN Li

	03H-14					

2019－2020 学年秋季学期(Autumn Semester)校历

年度 year	2019																		2020	
月份 month	九月(Sep)					十月(Oct)					十一月(Nov)				十二月(Dec)				一月(Jan)	
周次 week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
星期一（Mon）	26	2	9	16	23	30	7	14	21	28	4	11	18	25	2	9	16	23	30	6
星期二（Tue）	27	3	10	17	24	1 国庆节	8	15	22	29	5	12	19	26	3	10	17	24	31	7
星期三（Wed）	28	4	11	18	25	2	9	16	23	30	6	13	20	27	4	11	18	25	1 元旦	8
星期四（Thu）	29	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9
星期五（Fri）	30	6	13 中秋节	20	27	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10
星期六（Sat）	31	7	14	21	28	5	12	19	26	2	9	16	23	30	7	14	21	28	4	11
星期日（Sun）	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12
说 明	1、Autumn Semester starts from Sep. 2nd. 2、Vocations: Mid-Autumn Festival lasts from Sep.13th-Sep.15th; National Day lasts from Oct.1st-Oct.7th																			

Course Syllabus

Course title

Functional Nanostructure: Synthesis, Characterizations and Device Applications

Instructor(s)-in-charge:

Prof. HE Jun &Prof. WEI Zhixiang

Course type:

Lecture

Course Schedule:

4hrs/week by instructor. 1 hr/week by teaching assistant.

Course Assessment:

Homework: 12 assignments

Grading Policy:

The final grade consists of four components:
30% – Attendance
30% – Class behaviour including presentations
20% – Homework
20% – Final Project

Course Prerequisites:

Solid state physics, semiconductor physics, general chemistry，physical chemistry

Catalog Description:

This course includes three sections: inorganic semiconductor nanostructures, organics functional nanostructure and characterization of nanomaterials. The first section provides atoms-to-device introduction to the latest semiconductor quantum heterostructures. It covers nanostructures growth, their electronic, optical, and transport properties, their role in exploring new physical phenomena, and their utilization in devices. For the second part, by studying of this section, student should know the history and principles of organic electronics, understand how to use various strategies to produce organic functional nanomaterials, get the ideas how to construct organic electronic and optoelectronic devices, including filed effect transistors, light emitting diodes, and photovoltaics. The third provides Electron microscopic characterization of nanomaterials, Spectroscopic characterization of nanomaterials and some latest applications of nanomaterials.

Schedule of the course

section	content	hours	Date
1	Introduction of Nanoscience and Technology	4	September 11
2	Physics Basics	8	September 18 September 25
3	Typical Nanostructures	4	October 9
4	Growth Methods	8	October 16 October 23
5	Lab Tour	4	October 30

6	Characterizations of Nanostructures	6	November 6 November 13
7	Applications of Nanostructures	2	November 13
8	Introduction of Organic Electronics and Fabrication Method (Prof. Wei)	4	November 20
9	Fundamentals of Organic Electronics (Prof. Wei)	8	November 27 December 4
10	Properties and Applications of Organic Functional Materials (Prof. Wei)	8	December 11 December 18
11	Student Presentation	4	December 25
Total		60	

Contents of the course

1. Low dimensional inorganic semiconductors

1.1 History and principles

1.1.1 History of modern physics

1.1.2 The origin of conducting and semiconducting properties of low dimensional semiconductor

1.2 Growth techniques

1.2.1 Molecular beam epitaxy

1.2.2 Metal-organic Chemical Vapor Deposition

1.2.3 Chemical Vapor Deposition

1.3 Properties and applications

1.3.1 Opto-electronic devices

1.3.2 Solar and Environmental application

1.3.3 Nanogenerator and others

2. Organic functional materials

2.1 History and principles of organic materials

2.1.1 History of organic electronics

2.1.2 The origin of conducting and semiconducting properties of organic functional materials

2.2 Preparation of organic functional nanomaterials

2.2.1 Self-assembly of organic functional nanomaterials

2.2.2 Fabrication method of organic electronic devices

2.3 Properties and application

2.3.1 Organic filed effect transistors

2.3.2 Organic light emitting diodes, organic photovoltaics

3. Characterization of nanostructures

3.1 Electron microscopic (EM) characterizations

3.1.1 Introduction to transmission electron microscopy (TEM), scanning electron microscopy (SEM), electron diffraction and related techniques

3.1.2 Examples using electron microscopy to characterize nanostructures (such as nanowires, quantum dots, graphene, carbon nanotubes)

3.2 Spectroscopic characterizations
- 3.2.1 Introduction to FL, Raman and IR
- 3.2.2 Examples using FL, Raman and IR to characterize nanostructures (such as nanowires, quantum dots, graphene, carbon nanotubes)

Textbook and any related course material:

Low dimensional semiconductor structures: fundamental and device applications
Edited by Keith Barnham and Dimitri Vvedensky
Organic Electronics, Materials, Processing, Electronics, and Apllications
Edited by Franky So
Characterization of Materials, edited by Elton N. Kaufmann (editor-in-chief), Wiley-Interscience.
Transmission Electron Microscopy, edited by David B. Williams and C. Barry Carter, Springer.
Principles of Fluorescence Spectroscopy, third edition, edited by Joseph R. Lakowicz, Springer.
Introductory Raman Spectroscopy, second edition, edited by John R. Ferraro, Kazuo Nakamoto and Chris W. Brown, Elsevier.

Expected level of proficiency from students entering the course:

Mathematics: strong
Physics: strong
Chemistry: strong

Course title

Overview of Recent Development of Physics Part I

Instructor(s)-in-charge:

Prof. ZHOU Yufeng et al.

Course type:

Lecture

Catalog Description:

This course will introduce some basic concepts and frontiers of some theoretical physics directions, pay particular attention to general relativity, black hole physics, dark energy, dark matter and standard cosmological model, standard model of particle physics and beyond, Bose-Einstein condensation, phases and superconductivity in condensed matter, and so on.

Schedule of the course:

section	content	Professor	hours	Date
1	Origin of matter antimatter asymmetry	YU Jianghao	4	Sep. 12
2	Modern Cosmology	HUANG Qingguo	4	Sep. 19
3	Dark Matter	ZHOU Yufeng	4	Sep. 26
4	Condensed Matter Physics	QIN Shaojing	4	Oct. 10
5	New physics beyond the Standard Model	YANG Jinmin	4	Oct. 17
total			20	

Course title

Overview of Recent Development of Physics Part II-Overview of Modern Mechanics

Instructor(s)-in-charge:

Prof. SHI Xinghua

Course type:

Lecture

Office: R209@South Building, National Center for Nanoscience and Technology, CAS

Email: shixh@nanoctr.cn

Textbook: F. Bower, Applied Mechanics of Solids, CRC Press, 2009 (http://solidmechanics.org); Ya-Pu Zhao (赵亚溥), Lecture on Mechanics (力学讲义), 科学出版社, 2018

Pre-requisites and Co-requisites: None

Exam: Attendance 30%, Performance 20%, Homework 30%, Final project 20%

Course Content:

This course is designed primarily for the non-mechanics students who are interested in the mechanics-related problems in their future research work. This course is an introduction to the modern mechanics among which we would discuss the basic concepts and theories of deform and motion of an object, as well as the analytical methods. In the process, we will show how these concepts, theories and analytical methods work in the structural design, material selection and safety assessment in mechanical engineering, aerospace engineering, civil engineering, and other related fields like biology.

The topics we will cover include:

- Basic concepts of mechanics, such as displacement, strain, stress, constitutive relation, material strength, fracture, fatigue, etc
- Classical mechanics, Newtonian mechanics, Lagrangian mechanics
- Elastic mechanics, plastic mechanics, entropic elasticity, soil mechanics, biomechanics, etc
- Basic concepts of contact mechanics, fracture mechanics
- Basic concepts of finite element method (FEM)
- Basic concepts of fluid mechanics
- Some implications of mechanics you will find in life and research, like AFM, flexible electronics, gecko, cell, high speed train, etc

Schedule of the course:

section	content	hours	Date
1	Introduction of the basic concepts of mechanics, the implications, Classical mechanics, Newtonian Mechanics	4	Oct. 24
2	Lagrangian mechanics, elastic mechanics, entropic elasticity	4	Oct.31
3	Strength of materials, plastic mechanics, soil mechanics	4	Nov.7

4	Contact mechanics, fracture mechanics	4	Nov.14
5	Finite element method	4	Nov.21
6	Basic concepts of fluid mechanics, microfludics	4	Nov.28
7	Presentation, Lab tour	4	Dec.5
total		28	

Course title

Fundamentals of Modern Astronomy

Instructor(s)-in-charge:

Dr. Lijun Gou, Dr. Lan Wang

Teaching assistant:

Dr. Zhixia Shen (zshen@nao.cas.cn)

Course type:

Lecture

Course Schedule:

4hrs/week by instructors

Pre-requisites and Co-requisites:

None

Credits:

2.5

Course Content:

This course is designed primarily for the non-astronomy student who wishes to explore in depth a single topic in astronomy without becoming involved in detailed mathematical developments. In the process, we will see how scientific ideas develop and how scientists think about or approach problems.

This course is an introduction to our modern view of the universe, its contents, and how they got to be the way they are. Among the topics we will discuss are galaxies, quasars, stars, and black holes as well as the modern cosmology. For each of these objects, we will talk about what they are, how they are observed, how they form, and how they fit into the overall scheme of things in the universe. Due to the constraints of time, there are a number of topics, which we will not be able to discuss in detail. These omissions are made not because the subjects are of no interest to astronomers, but rather because we will not have time to discuss all of the interesting and important topics in astronomy.

Classical topics in astronomy, such as constellations and the appearance of the night sky, will not be covered in this course.

The topics we will cover include:

• The nature and lives of stars
• The stellar remnants (neutron stars and black holes, etc)
• The nature of our Milky Way Galaxy
• Properties of other galaxies and the foundation of modern cosmology
• Dark Energy, and the fate of the Universe

Course Objectives:

By the conclusion of this course, students should be able to:
•Explain the scientific process and how scientific theories are developed and tested.

•Recall basic physical concepts such as gravitational and conservation laws, and how light and matter interact.
•Describe the general characteristics of the universe.
•Apply scientific thinking to the natural world to understand, e.g. what powers the sun, why galaxies differ, and how the universe began.
•Formulate a scientific hypothesis, identify a testable prediction, verify by carrying out an experiment, and assess the results.

Textbook:
The Essential Cosmic Perspective, 7 th(or 6 th) Edition by Bennett, Donahue, Schneider, & Voit; Pearson Press.

Course title

Data Mining

Instructor(s)-in-charge:

Prof. LIU Ying

Course type:

Lecture

Course Schedule:

Mondays 13:30-15:10 pm & Wednesdays 13:30-15:10 pm
From Sept.9 to Dec.25, 4hrs per week.

Course Assessment:

Homework: 2 assignments, 1 project

Grading Policy:

Typically 30% homework, 30% project, 40% final.

Course Prerequisites:

data structure, computer algorithms, programming, database

Catalog Description:

The goal of the course is to provide the students with knowledge and hands-on experience in developing data mining algorithms and applications. Firstly, the course will introduce the motivation of data mining techniques. Then, present the principles and major classic algorithms in data mining. Next, the course will introduce some successful applications to the students. Finally, big data and the most recent techniques will be introduced as well.

Schedule of the course

section	content	hours
1	Introduction	4
2	Data Warehouse	4
3	Data Preprocessing	4
4	Association Rules Mining	6
5	Classification	6
6	Clustering	6
7	Sequence Mining	2
8	Applications	6
9	Big Data Mining	12
10	Project Discussion & Demo	8
11	Review	2
total		60

Contents of the course:

Section 1: Introduction

Motivation, major issues, major applications, characteristics

Section 2: Data warehouse

Model, architecture, operations

Section 3: Data pre-processing

Data cleaning, data transformation, data reduction

Section4: Association rules

Apriori, FP-Growth, Partition, DIC, DHP, multi-level association rules, quantitative association rules, major applications

Section 5: Classification

Decision tree, Bayesian Classifier, Classification by backpropagation, KNN classifier, statistical prediction models, major applications

Section 6: Clustering

Partitioning methods, hierarchical methods, density-based methods, grid-based methods, major applications

Section 7. Sequence mining

GSP, SPADE

Section 8: Applications

Credit scoring, oil exploration, customer relationship management, cosmological simulation

Section 9:Big data mining

Big data, big data characteristics, big data mining techniques including high performance mining, Web mining, stream mining, graph mining, text mining, cloud mining, etc.

Section 10: Project Discussion & Demo

Students and the instructor discuss the course projects in class, and students present their work and make demonstrations.

Textbook and any related course material:

Data Mining, Concepts and Techniques. Jiawei Han and MichelineKamber, Morgan Kaufmann, 2006.

Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Addison-Wesley, 2006.

Research papers: to be announced in class

Course title

Organometallic Chemistry-for Masters

Instructor(s)-in-charge:

Prof. SUN Wenhua & Associate Prof. MA Yanping

Course type:

Lecture

Course Schedule:

4hrs/week by instructor. 1 hr/week by teaching assistant.

Course Assessment:

Homework: 14 assignments

Grading Policy:

Typically 40% homework, 10% evaluation，30% for assessment (2 times, 15% each), 20% final. 5% plus to student presentation

Course Prerequisites:

General chemistry

Catalog Description:

Chemistry is the center of sciences, and organometallic chemistry is the useful tool for chemists to understand how organic molecules or groups interact with compounds of the inorganic elements. On the base of Organometallic Chemistry, the industries of chemical, petrochemical, pharmacy and organic materials have been continuously developing. With regard to Periodic Table of Elements, main group elements consisting of the s and p blocks and the transition elements of the d and f blocks would be discussed, respectively. Those organometallic compounds have been useful building blocks for nanoparticles and assembling materials. Importantly, organometallic compounds have been stoichiometric reagents and (pre)catalysts in tremendously industrial processes. In addition, organometallic compounds are also considerable for molecule biology. Therefore organometallic chemistry is a Capital Stone for scientists in chemistry, material science and nano-science.

Schedule of the course

section	content	hours	Date
1	Organometallic Chemistry: Definition & Scope Periodic Table of Elements *Evaluation regarding student background*	4	Sep. 9
2	Various ligands and their electrons contributions	4	Sep. 16
3	Alkali Metal Organometallics Alkaline Earth Metal Organometallics	4	Sep. 23
4	Zinc, Cadmium, and Mercury organometallics Stoichiometric reactions *Tutorial assessment*	4	Sep. 30
5	Synthetic methodology oriented	4	Oct. 14

	organometallic chemistry: A Practice		
6	Organometallics of the Boron Group Organometallics of the Carbon group	4	Oct. 21
7	Transition metal Organometallics: Common types of organometallic complexes; 16/18 ev; ligand types and behaviors and oxidation states	4	Oct. 28
8	Metal Carbonyl Complexes: Definition and types; from mononuclear to nanoparticles Industrial hydroformylation	4	Nov. 4
9	Organometallic compounds ligated by alkenes, dienes, and alkynes Student presentations (Topic discussions)	4	Nov. 11
10	Metallocene and Arene complexes	4	Nov. 18
11	Sigma Complexes *Tutorial assessment*	4	Nov. 25
12	Organometallic application: C-C and C-N cross couplings	4	Dec. 2
13	Industrial processes: ethylene oligomerization and olefin polymerization	4	Dec. 9
14	Student presentations (interpretation conceptual novelty to literature) Q and A sessions	4	Dec. 16
15	**Open note test (notebook and files within personal computer allowed, but not any text books)**	2	Dec. 23
	Official hour every week by Prof. SUN Wenhua and Prof. MA Yanping, if necessary		
total		60	

Textbook and any related course material:

Organometallics and Catalysis: An Introduction Edited by Manfred Bochmann. Oxford University Press 2015.

THE ORGANO METALLIC CHEMISTRY OF THE TRANSITION METALS Sixth Edition, Edited by Robert H. Crabtree. John Wiley & Sons, Inc 2014.

Course title

Organometallic Chemistry and Catalysis-for Doctors

Instructor(s)-in-charge:

Prof. SUN Wenhua & Associate Prof. MA Yanping

Course type:

Lecture

Course Schedule:

4hrs/week by instructor. 1 hr/week by teaching assistant.

Course Assessment:

Homework: 14 assignments

Grading Policy:

Typically 40% homework, 10% evaluation，30% for assessment (2 times, 15% each), 20% final. 5% plus to student presentation

Course Prerequisites:

General chemistry

Catalog Description:

Chemistry is the center of sciences, and organometallic chemistry is the useful tool for chemists to understand how organic molecules or groups interact with compounds of the inorganic elements. On the base of Organometallic Chemistry, the industries of chemical, petrochemical, pharmacy and organic materials have been continuously developing. A catalyst increases the rate of a reaction without being consumed and without changing the thermodynamics of the reaction, providing bases for modern chemical industries. With regard to Periodic Table of Elements, main group elements consisting of the s and p blocks and the transition elements of the d and f blocks would be discussed, respectively. Those organometallic compounds have been useful building blocks for nanoparticles and assembling materials. Importantly, organometallic compounds have been stoichiometric reagents and (pre)catalysts in tremendously industrial processes. Therefore organometallic chemistry and catalysis are the Capital Stone for scientists in chemistry, material science and industry.

Schedule of the course

section	content	hours	Date
1	Organometallic Chemistry: Definition & Scope Introduction to Catalysis *Evaluation regarding student background*	4	Sep. 10
2	Periodic Table of Elements Various ligands and their electrons contributions	4	Sep. 17
3	Alkali Metal Organometallics Alkaline Earth Metal Organometallics	4	Sep. 24
4	Zinc, Cadmium, and Mercury organometallics Stoichiometric reactions	4	Oct. 8

	Tutorial assessment		
5	Synthetic methodology oriented organometallic chemistry: A Practice	4	Oct. 15
6	Organometallics of the Boron Group Organometallics of the Carbon group	4	Oct. 22
7	Transition metal Organometallics: Common types of organometallic complexes; 16/18 ev; ligand types and behaviors and oxidation states	4	Oct. 29
8	Metal Carbonyl Complexes: Definition and types; from mononuclear to nanoparticles Industrial hydroformylation	4	Nov. 5
9	Organometallic compounds ligated by alkenes, dienes, and alkynes Student presentations (Topic discussions)	4	Nov. 12
10	Metallocene and Arene complexes	4	Nov. 19
11	Sigma Complexes Hydrogenation *Tutorial assessment*	4	Nov. 26
12	Organometallic application: C-C and C-N cross couplings and new progresses	4	Dec. 3
13	Industrial processes: ethylene oligomerization and olefin polymerization	4	Dec. 10
14	Student presentations (interpretation conceptual novelty) Q and A sessions	4	Dec. 17
15	**Open note test (notebook and books along with personal computer allowed, but no discussion)**	4	Dec. 24
	Official hour every week by Prof. SUN Wenhua and Prof. MA Yanping, if necessary		
total		60	

Textbook and any related course material:

Organometallics and Catalysis: An Introduction Edited by Manfred Bochmann. Oxford University Press 2015.

THE ORGANO METALLIC CHEMISTRY OF THE TRANSITION METALS Sixth Edition, Edited by Robert H. Crabtree. John Wiley & Sons, Inc 2014.

Course title

The Frontier of Genomics and Precision Medicine

Instructor(s)-in-charge:

Prof. Yingli Sun (Beijing Institute of Genomics, Chinese Academy of Sciences)
Prof. Zhihua Zhang (Beijing Institute of Genomics, Chinese Academy of Sciences)
Prof. Cheng Li (Peking University, School of Life Sciences)
Prof. Yibo Gao (Cancer Hospital, Chinese Academy of Medical Sciences)

Course type:

Lecture

Course Schedule:

4hrs/week by instructor. 1 hr/week by teaching assistant.

Course Assessment:

Homework: 2 assignments

Grading Policy:

Attendance: 10% , Homework: 30% , Final examination: 60%

Course Prerequisites:

Molecular biology, Statistics, Computer programming

Catalog Description:

Epigenetics and chromatin structures, DNA replication and DNA damage, and response and repair of DNA damage in chromatin environment. The first section provides an introduction to the concept of "epigenetics" and the structures of chromatins. It covers chromatin remodeling and the modifications of DNA and histones, and their roles in chromatin structure maintenance and chromatin based signal transduction. For the second part, by studying of this section, student should know the principles of DNA replication and cellular checkpoint, understand how cells sense and repair damaged DNA. The third provides current understanding of how chromatin modifications or higher structures contribute to DNA damage response (DDR) in chromatin context, and in this section we will also discuss how DDR defects will contribute to cancer development.

Contemporary life sciences and medicine are moving towards the era of large data as represented by high-throughput sequencing. How to model, analyze and interpret genomic data will determine whether we can quickly and accurately discover new biological phenomena and rules, and provide accurate medical care for patients. This course will introduce common data types in genomics, such as DNA-seq, RNA-seq, and statistical analysis and graphing methods commonly used in data analysis, including exploratory data analysis, linear regression, data dimension reduction and clustering. The course will discuss genomics literature and data, and use the R language programming environment for data analysis and graphing exercises.

Schedule of the course

section	content	hours	Date
1	Introduction to Molecular Biology and Genomics	4	September 11

2	DNA and DNA Replication	4	September 18
3	RNA,Transcription and RNA Processing	4	September 25
4	Protein and genetic codon	4	October 9
5	Regulation of gene expression	4	October 16
6	Research progress on Genomics	4	October 23
7	Introduction to R language and graphics	4	October30
8	Linear regression and applications to genomics data	4	November 6
9	Transcription regulatory factor binding sites and human disease	4	November 13
10	Noncoding RNA and Human Disease	4	November 20
11	3D genomics and human disease	4	November 27
12	Introduction to Gene Regulatory Network	4	December 4
13	Epigenetics and chromatin structures	4	December 11
14	DNA damage and DNA replication	4	December 18
15	Response and repair of DNA damage in chromatin environment	4	December 25
total		60	

Contents of the course

Section 1: Introduction to Molecular Biology and Genomics

Section 2: DNA and DNA Replication

1. Content and Structure of chromosome
2. Basic element and structure of DNA
3. DNA replication

Section 3: RNA,Transcription and RNA Processing

1. Transfer of Genetic Information: The Central Dogma
2. The Process of Gene Expression
3. Transcription in Prokaryotes
4. Transcription and RNA Processing in Eukaryotes
5. Interrupted Genes in Eukaryotes: Exons and Introns
6. Removal of Intron Sequences by RNA Splicing

Section 4: Translation and Genetic Code

1. Elements and process in Translation
2. Structure and function of protein
3. About Genetic code

Section 5: Regulation of gene expression

1. Gene expression refers to the process of gene transcription and Translation
2. Gene expression with temporal specificity and spatial specificity
3. Gene expression and regulation have a big difference between each other

4. Regulation of gene expression is necessary for the organism growth and development

Section 6: Research progress on Genomics

5. Genome Project
6. Single Cell Sequence
7. Epigenetics Research Progress
8. The Cancer Genome Atlas
9. Gene Detection with Genomic Technology

Section 7: Introduction to R language and graphics

1. Introduction to genomics data
2. Introduction to R language
3. Demo of R language
4. R syntax
5. R flow control
6. Use R to make graphs
7. Efficient programming in R

Section 8: Linear regression and applications to genomics data

1. Correlation and association
2. Continuous vs. discrete variables
3. Simple linear regression
4. Multiple linear regression
5. Selection of variables and model validation
6. Application examples to genomics data
7. Use linear regression in R

Section 9: Transcription regulatory factor binding sites and human disease

1. Basic principle of transcription;
2. Identification of transcription regulatory factor binding sites
3. Transcription regulatory factor binding sites and human disease
4. Promoter and enhancer identification methods

Section 10: Noncoding RNA and Human Disease

1. DNA methylation, histone Modification and Gene expression Regulation
2. Basic experimental techniques for Noncoding RNA
3. Noncoding RNA and Human Disease
4. Basic experimental techniques for 3D Genome

Section11: 3D genomics and human disease

1. Methods for recognition of Compartment A/B and TAD
2. Reconstruction of the 3D genomic structure
3. Chromatin loop identification methods based on multi-omics approach
4. 3D genomics and human disease

Section 12: Introduction to Gene Regulatory Network

1. Introduction to Gene Regulatory Network
2. Basic Concepts of population Genetics I
3. Basic Concepts of population Genetics II.
4. Application of population Genetics in Precision Medicine

Section 13: Epigenetics and chromatin structures

1. History and principles epigenetics
2. Chromatin structures
   (1) From histone to chromatin
   (2) Chromatin remodeling
   (3) Modifications of DNA and histones
   (4) Chromatin structure maintenance and chromatin based signal transduction

Section 14: DNA damage and DNA replication

1. The principles of DNA replication
   (1) DNA replication, replication fork stalling and collapse
   (2) Cell cycle and checkpoint
2. DNA damage response (DDR)
   (1) Different types of DNA damage
   (2) Damage sensing and signal transduction
   (3) Repair pathways

Section 15: Response and repair of DNA damage in chromatin environment

1. Chromatin remodeling and DDR
2. Histone modifications and DDR
3. Chromatin relaxation and compaction on DDR
4. How DDR defects will contribute to cancer development

Textbook and any related course material:

1. *《An Introduction to Statistical Learning with Applications in R》*
Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, Springer
Free PDF version: http://www-bcf.usc.edu/~gareth/ISL/
NOTE: This book is only suggestive, not imperative.
2. *《Epigenetics》*, Cold Spring Harbor Laboratory Press; 2 edition S by C. David Allis, Marie-Laure Caparros, Thomas Jenuwein , Danny Reinberg.
3. *《The Biology of Cancer》*, Second Edition，Robert A. Weinberg，Garland Science

Expected level of proficiency from students entering the course:

Mathematics and statistics: medium
Computer programming: medium
Molecular biology: medium
Genetics: entry level
Cell biology: entry level
Math: Basic calculation

Course title

Plant Molecular Biology and Genomics

Instructor(s)-in-charge:

Profs. Hai-Chun Jing, Rong-Cheng Lin, Ya-Long Guo, Lei Wang

Course type:

Lecture

Course Schedule:

4hrs/week by instructors

Course Assessment:

Homework: 15 assignments

Grading Policy:

Typically 40% homework, 20% attendance, 40% final.

Course Prerequisites:

without

Catalog Description:

This course invites lab bench-based researchers from Institute of Botany, Chinese Academy of Sciences, to share their cutting-edge knowledge of Plant Molecular Biology and Genomics. The course will explain the concept of the gene, genome and epigenome, and theories and experimental tools/platforms to explore their variations, functions, interactions and regulatory networks in the context of plant speciation and evolution, growth and development as well as adaptation to the environments. Emphasis will also be given to how to translate know-hows gained from the basic science into plant breeding. The course puts more weight into how to rationalize, design and execute scientific researches, rather than to spoon feed the attendees with jargons to memorize. We encourage actively answer-seeking rather than rote learning, do require the attendees to have ideally at least college-level education in Plant Biology and relevant fields.

Schedule of the course

Section	Content	Hours	Date	Tutor
1	The Gene, Genome and Epigenome in Plants, Plant Sciences and *Science* 125 questions	12	September 20 September 27 Not determined	Hai-Chun Jing
2	Plant Circadian Molecular System and Epigenetic Controls	12	October 11 October 18 October 25	Lei Wang
3	Molecular Biology of Photo-morphogenesis and Light Signaling	8	November 1 November 8	Rong-Cheng Lin
4	Molecular Biology and Genomics for Plant Breeding	12	November 15 November 22 November 29	Hai-Chun Jing
5	Plant Genome Biology and Evolution	12	December 6 December 13 December 20	Ya-Long Guo
6	Q&A	4	Not determined	Hai-Chun Jing

total		60		

Contents of the course

Section 1: The Gene, Genome and Epigenome in Plants (Hai-Chun Jing)

1. The Gene

- **The Missing Science of Heredity**
- **The Dreams of Genetists**
- **Plant Genetics**

2. The Genome

- **The Spacious Genome**
- **RNA out of the Shadows**
- **Code, Non-Code, Garbage, and Junk**

3. The Epigenome

- **The Discovery of Epigenetics**
- **DNA Methylation**
- **Histone Modifications**
- **Chromatin Remodelling**
- **Interactions between Different Epigenetic Modifcations**

Section 2:Plant Genome Biology and Evolution（Ya-Long Guo, three afternoons）

- **Genome sequencing and genomics**
- **Comparative genomics**
- **Population genomics and adaptive evolution**

Section 3: Molecular Biology of Light Signaling and Photomorphogenesis (Rong-Cheng Lin, two afternoons)

- **Light and plant development**
- **Photoreceptors: light perception**
- **Light signaling transduction**
- **Photo morphogenesis**

Section 4: Plant Circadian Molecular System and Epigenetic Controls (Lei Wang, three afternoons)

- **Plant circadian molecular system (Concept, assembly of core oscillator)**
- **Regulation of circadian clock core oscillator**
- **Circadian clock and plant development**

Section 5: Molecular Biology and Genomics for Plant Breeding (Hai-Chun Jing)

- **Crop Domestication and Plant Genetic Resources**
- **Plant Biotechnology and Moelcular Breeding**
- **Future of Plant Breeding**

Textbook and any related course material

1. Epigenetics, edited by Allis CD, Jenuwein T and Reinberg D, Caparros ML (editor-in-chief), Cold Spring Harbor Laboratory Press, New York.

2. Genes Ⅷ, Benjamin Lewin.

3. Genomics of tropical crop plants: Moore PH, Ming DR. Sringer, 2008.

4. Plant Genomics: Methods and Protocols. Daryl J. Somers DJ, PeterLangridge, J.P. Gust. Humana Press Inc.2011.

5. Plant Genomics: Methods and Protocols. Busch.Humana Press Inc. 2017.

Course title

Biophysics and Organelle Biology

Instructor(s)-in-charge:

Prof. Pingsheng Liu

Course type:

Lecture

Course Schedule:

See Schedule of the course

Course Assessment:

Homework: 7 assignments

Grading Policy:

70% homework, 30% classroom activities.

Course Prerequisites:

Without

Catalog Description:

1. **Introduction of Biophysics**
   Definition; Contents
2. **Macromolecules**
   Functions; Regulation; Structure
3. **Cellular structures and organelles**
   Cytoskeletons; Organelles
4. **Lipid Storage Disorders and Metabolic Diseases**
   Cardiovascular disease; None alcoholic fatty liver disease
5. **Introduction of Lipid Droplets**
   History; Distributions; Difference with lipoproteins and other cellular organelles; Recent progress; Uncertainty and problems; Future studies
6. **Structural Proteins and Protein Composition**
   Structural Proteins: PLINs; Oleosins; MPL, MLDP, MLDS, LDP, CLDPs
   Protein Composition: Lipid synthetic and catalytic; Membrane trafficking; Signaling; Protein degradation
7. **Formation and Functions**
   Formation: Biogenesis; Growth and degradation; Fusion and fission
   Functions: Storage; Trafficking (movement and interaction with other cellular organelles); Lipid synthesis; Signaling; Protein degradation; DNA protection
8. **Lipid Droplets in Mammals and Other Organisms**
   Mammals: Adipose tissue; Mammary gland; Liver; Macrophages; Lymphocytes; Muscle; Other mammalian cells
   Plants: Plant seeds; Chloroplasts
   Genetic Model Organisms: Drosophila; C. elegans
   Microorganisms: Yeast; Green algae; Bacteria
9. **Lipid Droplet Evolution**
   Origin; Conserved properties
10. **Methods in Lipid Droplet Biology**
    Isolation; Proteomics; Imaging; Fusion; Fission; Movement; Genetic screen;

Artificial lipid droplets

Course material:

All references are list in course ppt.

You are welcome to copy the ppt.

Course title

Fundamental Immunology

Instructor(s)-in-charge:

Prof. Min Fang & Assoc Prof. Xuefeng Duan

Course type:

Lecture

Course Schedule:

4hrs/week by instructors. 32 hrs in total by Prof. Min Fang; 8 hrs in total by Assoc Prof. Xuefeng Duan.

Course Assessment:

Homework: 5 assignments

Grading Policy:

Typically 50% homework, 20% attendances; 30% final presentation.

Course Prerequisites:

Immunology, Cell Biology, Microbiology，Virology

Catalog Description:

Fundamental Immunology is designed as a comprehensive course of immunology for research postgraduates in biology field. The class will give students a general view of immunology and some detailed development in certain selected area of immunology. As a course for postgraduates research case studies are incorporated into the course to provide examples for researches carried out in respective fields. This course covers the components of the immune system, Innate immunity, the cell biology of antigen processing and presentation, antibody and B cells, T cell response, the molecular structure and assembly of MHC molecules, and the pathogenesis of immunologically mediated diseases and immune system as defense system against infectious disease and tumor, and immunology as tool for general biology including antibody technology and flow cytometry. The course is structured as a series of lectures and mini-seminars in which individual research cases are discussed with faculty tutors. It will cover the following topics:

Schedule of the course

section	content	hours	Date
1	**Introduction of Immunology** Introduction to Immunology; General Properties of Immune Responses; Cells and Tissues of the Immune Systems; The development stages of Immunology.	4	September 10 Prof. Min Fang
2	**Innate Immunity** Features of Innate Immune Recognition; Components of the Innate Immune System; The Intersection of Innate and Adaptive Immunity	4	September 17 Prof. Min Fang
3	**NK cell development and function** General properties of NK cells; NK cell development and differentiation; NK cells in	4	September 24 Prof. Min Fang

	anti-viral immunity; Memory NK cells		
4	**Immunoglobulins and B lymphocytes** Immunoglobulins: Structure and Function; Antigen-antibody interactions and Monoclonal Antibody; B lymphocytes Development and Biology; B lymphocytes Signaling Mechanisms and Activation.	4	October 08 Prof. Min Fang
5	**T lymphocytes** T cell Antigen Receptors; T lymphocyte Signaling Mechanisms and Activation; Development of T cells; Peripheral T lymphocyte responses and Function.	4	October 15 Prof. Min Fang
6	**Major Histocompatibility Complex (MHC) Molecules and Antigen Presentation** MHC Structure, Function, and Genetics; Cell Biology of Antigen Processing and Presentation.	4	October 22 Prof. Min Fang
7	**Immunity to infectious Agents** The Immune Responses to Parasites and bacteria; Immunity to Viruses; Vaccines; Research case study.	4	October 29 Prof. Min Fang
8	**Immunologic Tolerance and Autoimmunity** B lymphocyte tolerance, and tolerance induced by foreign protein antigens; T lymphocyte tolerance; Mechanisms of autoimmunity; Advances in immunologic tolerance and autoimmunity	4	November 05 Assoc Prof. Xuefeng Duan
9	**Immunity to Tumors** Overview and tumor antigens; Immune responses to tumors and evasion of immune responses by tumors; Immunotherapy for tumors and the role of innate and adaptive immunity in promoting tumor growth; Advances in immunity to tumors	4	November 12 Assoc Prof. Xuefeng Duan
10	**Students Final Presentation** 3-5 minutes per student, the student can choose any topic in immunology and discuss their understanding and thoughts.	4	November 19 Prof. Min Fang
total		40	

Contents of the course

Section 1: Introduction of Immunology and Innate Immunity

1. Introduction of Immunology;
2. Cells and Tissues of the Immune Systems;
3. The development stages of Immunology
4. Features of Innate Immune Recognition;
5. Components of the Innate Immune System;
6. NK cells: General properties of NK cells; NK cell development and differentiation; NK cells in anti-viral immunity; Memory NK cells

Section 2: Adaptive Immunity

1. Humoral Immunity: Immunoglobulins: Structure and Function; Antigen-antibody interactions and Monoclonal Antibody; B lymphocytes evelopment and Biology; B lymphocytes Signaling Mechanisms and Activation.
2. Cellular Immunity: T cell Antigen Receptors; T lymphocyte Signaling Mechanisms and Activation; Development of T cells; Peripheral T lymphocyte responses and Function.
3. Antigen Presentation: MHC Structure, Function, and Genetics; Cell Biology of Antigen Processing and Presentation.

Section 3: Immune Systems and Diseases

1. Immunity to infectious Agents: The Immune Responses to Parasites and bacteria; Immunity to Viruses; Vaccines; Research case study.
2. Immunologic Tolerance and Autoimmunity: B lymphocyte tolerance, and tolerance induced by foreign protein antigens; T lymphocyte tolerance; Mechanisms of autoimmunity; Advances in immunologic tolerance and autoimmunity.
3. Immunity to Tumors: Overview and tumor antigens; Immune responses to tumors and evasion of immune responses by tumors; Immunotherapy for tumors and the role of innate and adaptive immunity in promoting tumor growth; Advances in immunity to tumors

Textbook and any related course material:

Cellular and Molecular Immunology, 8th Edition, Edited by Abul K .Abbas, Andrew H. Lichtman, and Shiv Pillai

Fundamental Immunology, 7th Edition, Edited by Paul, William E.

Principles of Virology, 3rd Edition, Edited by S.J. Flint, L.W. Enquist, V.R. Racaniello, A.M. Skala

Expected level of proficiency from students entering the course:

Cell Biology: strong

Immunology: basic

Virology: basic

Course title

Model Animals in Developmental Biology

Instructor:

Prof. YUAN Li

Course description:

The goal of this course is to introduce postgraduate students to the field of animal developmental biology, and to help them understand how the choice of model organisms matters for their research.

Topics related to growth, differentiation, morphogenesis and organogenesis in different model animals would be covered. Using genetic and molecular biological techniques, developmental biologists have moved beyond animal developmental anatomy and now study the causal mechanisms of development using a number of invertebrate and vertebrate model organisms. Thus, animal developmental Biology has a rich and fascinating history as people, events, and disciplines coalesced to form the field. It continues as one of the most rapidly expanding areas of biological research.

Course type:

Lecture, mini-seminar, discussions

Notes:

PowerPoint slides for each lecture will be sent to you in advance. During the lecture period, you will be presented with a series of discussion questions. These questions are designed to challenge you to think critically about the principles of animal developmental biology. The goal of these questions is to introduce you to the process of interpreting scientific data as well as the experimental paradigms that form the foundation of developmental biology. I will benefit from these questions by gaining feedback about your level of understanding of the presented concepts, and you can in turn use these discussion questions to gauge your own grasp of the material.

Studying developmental biology is rigorous and demanding, but the rewards can be great. I look forward to learning with you.

Grading information:

Components of Model Animals in Developmental Biology will be worth the following percentages of your total grade:

Homework assignments: 20%

Discussion questions: 20%

Attendance: 10%

Final open-book examination: 50%

Schedule of the course

Chapter	Content	Hours	Date
1	Introduction to model animals in developmental biology	4	Sep.10
2	Studying developmental biology – tools and techniques	4	Sep.17
3	Introducing animal embryonic development	4	Sep.24

4	Cell-cell communication in development	4	Oct.8
5	Germ cells, fertilization and sex determination	4	Oct.15
6	Early *Drosophila* development and genes that pattern the *Drosophila* body plan	4	Oct.22
7	Early amphibian development	4	Oct.29
8	Early zebrafish development	4	Nov.5
9	Early development in chickens	4	Nov.12
10	Early mammalian development	4	Nov.19
11	Early development in *C. elegans*	4	Nov.26
12	Development of the nervous system Section 1: The Emergence of the Ectoderm: central nervous system and epidermis Section 2: The neural crest cells and axonal specificity	8	Dec.3 Dec.10
13	Organogenesis: (1) Paraxial mesoderm: somitogenesis (2) Intermediate mesoderm: the urogenital system	4	Dec.17
	Repetition; Open-book examination	4	Dec.24
Total		60	

Course title

Plant Physiology and Developmental Biology

Instructor(s)-in-charge:

Prof. CHENG Youfa

Course type:

Lecture, mini-seminar, discussions

Catalog Description:

This course is designed as an introduction course of plant physiology and developmental biology for graduate students. In this course, we will discuss plant physiology and developmental events during plant life and the underlying mechanisms controlling plant developmental processes and responses to environmental stimuli. Emphasis will be given on the molecular genetic basis of the developmental events. The entire life span will be examined, from gametocyte development to embryogenesis and post-embryonic development, such as root, leaf, flower and fruit development. Hormones and signal transduction will also be discussed.

It will cover the following topics:

Schedule of the course

section	content	hours	Date
1	Introduction to Plant Physiology and Developmental Biology	4	Sept-9
2	Methods in Plant Physiology and Developmental Biology I	4	Sept-16
3	Methods in Plant Physiology and Developmental Biology II	4	Sept-23
4	Hormone and Signal Transduction in Plants I	4	Sept-30
5	Hormone and Signal Transduction in Plants II	4	Oct-14
6	Embryogenesis I	4	Oct-21
7	Embryogenesis II	4	Oct-28
8	Stem Cell and Meristem I	4	Nov-4
9	Stem Cell and Meristem II	4	Nov-11
10	Organogenesis I	4	Nov-18
11	Organogenesis II	4	Nov-25
12	Flowering and Flower Development I	4	Dec-2
13	Flowering and Flower Development II	4	Dec-9
14	Stress physiology	4	Dec-16
15	exam	4	Dec-23
total		60	

Course title

Environmental and Natural Resource Economics

Instructor(s)-in-charge:

Prof. DENG Xiangzheng, Prof. LIU Yuexian, Dr. LI Zhihui

Course type:

Lecture

Course Schedule:

4hrs/week by instructors. 1 hr/week by teaching assistant.

Catalog Description:

The Environmental and Natural Resource Economics course is designed for research postgraduates in Environmental Sciences field. The class will give students a general view of environmental and natural resource economics and some detailed development in certain selected areas. As a course for research students, a mini-seminar series are incorporated into the course to provide examples for researches carried out in respective fields. This course covers the components of the environmental economics and natural resource utilization analysis and research, their key definitions and research approaches, economics of natural science based environmental changes and assessment, natural resources categories and their scientific issues, issue-oriented analysis and discussion of environmental justice and sustainable development, etc. The course is structured as a series of lectures and mini-seminars, in which individual research cases are discussed with faculty tutors. It will cover the following topics:

Schedule of the course

Section	Content	hours	Date
1	**The Economic Approach** 1.1 The Human–Environment Relationship: -the role of economics; -studying human behavior in a laboratory; -the environment as an asset. 1.2 Environmental Problems and Economic Efficiency: -property rights and efficient market allocation; -improperly designed property rights systems; -the pursuit of efficiency. 1.3 Externalities as a Source of Market Failure: -public goods; -imperfect market structures; -government failure; -an efficient role for government.	4	September 10
2	**Evaluating Trade-Offs** 2.1 Normative Criteria for Decision Making: -pollution control; -preservation *versus* development; -issues in benefit estimation. 2.2 Approaches to Cost Estimation: -the Treatment of Risk; -distribution of benefits and costs; -choosing the discount rate; -divergence of social and private discount rates; -cost-effectiveness analysis;	8	September 17 September 24

	-impact analysis. 2.3 Valuing the Environment: -identification of types of values of environment; -classification of valuation methods; -preference based models (stated preference, revealed preference, travel cost, hedonic property and wage, averting expenditure). 2.4 GIS based modeling works: -examples and practices.		
3	**Dynamic Efficiency and Sustainable Development** 3.1 Efficiency vs Equality: -a two-period model; -defining intertemporal fairness; -efficient allocations and sustainability criterion. 3.2 Sustainable Development: -market allocations; -efficiency and sustainability; -trade and environment. 3.3 Environmental Policy for Sustainable Development: -implications for environmental policy; -depletable resource allocation; -efficient intertemporal allocation; -market allocation of depletable resource.	8	October 8 October 15
4	Student presentations and discussions	4	October 22
5	**Replenishable but Depletable Resources: Water** 5.1 The Potential for Water Scarcity: -the efficient allocation of scarce water; -water transfers; -water markets; -water prices; -GIS and water resource. 5.2 Watershed based efficiency and cost-effectiveness: -nature of water pollution problem; -water pollution control. 5.3 Mini-seminars: -group discussions	4	October 29
6	**A Locationally Fixed, Multipurpose Resource: Land** 6.1 The Economics of Land Allocation: -land use; -land use conversion; -examples and practices. 6.2 Efficiency of land use: -sources of inefficient use and conversion; -innovative market-based policy remedies; -establishing property rights; -transferable development rights. 6.3 Mini-seminars: -group discussion.	8	November 5 November 12
7	**Reproducible Private Property Resource: Agriculture and Food Security** 7.1 Global Scarcity and food security: -outlook for the future; -the role of agricultural policies; -distribution of food resource.	4	November 19

	7.2 Climate changes and food security: -feast and famine cycles; -examples and summary, 7.3 Mini-seminars: -group discussion.		
8	Student presentations and discussions	4	November 26
9	**Land Storable, Renewable Resources: Forests** 9.1 Sources of Inefficiency: -perverse incentives for the landowner and nations; -poverty and debt; -sustainable forestry. 9.2 Public Policy: -carbon sequestration credits; -REDD. 9.3 Mini-seminars: -group discussion.	4	December 3
10	**Economics of Pollution Control** 10.1 The Efficient Allocation of pollution: -a pollutant taxonomy; -market allocation of pollution; -efficient policy responses. 10.2 Policy Analysis: -cost-effective policies for uniformly mixed fund pollutants: -cost-effective policies for nonuniformly mixed surface pollutants: -responses to changes in the regulatory environment; -price volatility; -instrument choice under uncertainty; -product charges as an indirect form of environmental taxation. 10.3 Air Pollutions: -conventional pollutants; -cost-effectiveness of the command-and-control approach; -innovative approaches; -regional pollutants. 10.4 Mini-seminars: -group discussion.	4	December 10
11	Student presentations and discussions	4	December 17
12	**Course conclusion and discussion**	2	December 24
13	**Final Exam**	2	December 24
Total		60	

Course title

Overview of Climate Change Sciences

Instructor(s)-in-charge:

Prof. KANG Shichang et al.

Course type:

Lecture

Grading Policy:

Part one: Attendance (20%)

Part two: Presentation (30%)

Part three: Final Exam (50%)

Catalog Description:

*Climate Change Science 2019 fall semester is designed as an introductory course in the **climate system change and related Issues** for graduate students majored in Earth Sciences. The class will give students an overview of climate system and its changes and impacts, mitigation and adaptation of climate changes as well as some updated developments in selected fields. As a course for graduate students a mini-seminar series are incorporated into the course to provide examples of research conducted in selected fields. This course covers the components of the climate system including atmosphere, cryosphere, hydrosphere, biosphere, anthroposphere, and their changes as well as mechanisms, forcing, attribution and predictions of the changes, multisphere interactions in Earth surface. Impacts, mitigation and adaptation of climate changes and regional and global sustainable development are also introduced. The course is structured as a series of lectures and mini-seminars in which individual research cases are discussed with faculty tutors.*

Schedule of the course and contents

Section	Content	hours	Date
1	**Overview of Climate Change** 1.1 Weather, climate and climate System 1.2 What has hanged 1.3 Why has it changed 1.4 How will it change	8	Sept. 10 Sept. 17 S. Kang
2	**Paleo-climate Change** 2.1 Glacial and interglacial cycle 2.2 Holocene 2.3 Past 2000 yeas 2.4 Anthropocene	4	Sept. 24 Q. Zhang
3	**Changes in Atmospheric Composition** 3.1 Well mixed greenhouse gases 3.2 Short lived gases 3.3 Aerosols and precurses 3.4 Toxic species	8	Oct. 8 Oct. 15 Q. Zhang
4	**Changes in Climate extremes** 4.1 Temperature extremes 4.2 Precipitation extremes 4.3 Tropical storms	4	Oct. 22 Q. You

5	**Changes in Atmospheric Circulation** 5.1 Global atmospheric circulation 5.2 Stratospheric circulation 5.3 Mid to high latitude circulation (jets) 5.4 Tropical circulation (Hadly cycle, ENSO) 5.6 Monsoon system 5.7 Climate pattern	8	Oct. 29 Nov. 5 Q. You
6	**Changes in the Cryosphere** 6.1 Glacier 6.2 Ice sheet 6.3 Permafrost 6.4 Seasonal snow 6.5 Sea ice 6.6 Other ice	4	Nov. 12 S. Kang
7	**Changes in Hydrological Cycle** 7.1 Precipitation 7.2 Streamflow and runoff 7.3 Evapotranspiration including Pan Evaporation 7.4 Surface and tropospheric humidity 7.5 Clouds	4	Nov. 19 L. Cuo
8	**Modeling Climate Change and Prediction** 8.1 Aerosol and clouds 8.2 Anthropogenic and natural radiative forcing 8.3 Detection and attribution of climate change 8.4 CMIP5 8.5 Regional climate model 8.6 Climate change prediction	8	Nov. 26 Dec. 3 Z. Ji
9	**Impacts, Vulnerability of Climate Change** 9.1 Assessment methods of impacts and vulnerability 9.2 Major fields of impacts and vulnerability 9.3 Major regions of impacts and vulnerability 9.4 Resilience in response to climate change	4	Dec. 10 X. Wang
10	**Mitigation and Adaptation of Climate Change** 10.1 Mitigation approaches 10.2 International policies for mitigation 10.3 Adaptation under sustainable development	4	Dec. 17 X. Wang
11	**Student Presentation and seminar**	4	Dec. 24 S. Kang
Total		60	

Course title

Earth System Science Part I-Introduction to Remote Sensing

Instructor(s)-in-charge:

Prof. Fang Chen

Course type:

Lecture

Course Schedule:

Mondays from 13: 30 - 17:10 p.m.

September 09, 2019 September 16, 2019 September 23, 2019
September 30, 2019 October 14, 2019 October 21, 2019
October 28, 2019

Course Assessment:

Homework: 2 assignments

Grading Policy:

The grading for this course will be based on:
- Participation (30% of grade)
- Assignments (30% of grade)
-Short presentation (20% of grade)
-Comprehensive final exam (20% 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. Students will freely form a group (including maximum 3 members in each group) and each group is expected to give a group presentation on the topical area of Assignment-2 in front of the class. The presentation will be followed by discussion during which other students are expected to ask questions and engage. The group presentations will be limited to 10 minutes and Q&A will be limited to 5 minutes (depend on the number of students). Students will be graded both as presenters and participation in discussion.*

Course Prerequisites:

This course does not have any pre-requisites.

Catalog Description:

This course is intended to provide an introduction to remote sensing, with particular attention to the role of remote sensing for the monitoring the Earth's land surface. It will introduce the basic principles of image interpretation, remote sensing, and digital data processing in relation to optical, thermal, and microwave remote sensing systems. Examples of remote sensing applications will be resented along with methods for obtaining quantitative information from remotely sensed imagery.

Writing Assignments and Group Presentation

1. *Assignment-1-- Write a short (3-4 page) paper on **a topic of your understanding of remote sensing** related to the class subject matter. DUE in class, Sept.23.*
2. *Assignment-2-- Write a short (3-4 page) paper on the topic of **the use of remote sensing for disaster management**. DUE in class, Oct.28.*

3. *Group Presentation--Students will freely form a group (including maximum 3 members in each group) and each group is expected to give a group presentation on the topic of the use of remote sensing for disaster management. Each group should send the group members' information (i.e., Name and Student ID) to teaching assistant* ***due inSept.30****.*

Keys to Success:

This course is challenging for many students because of the highly quantitative nature of the field of remote sensing. In order to assist all students in the course, I have identified several keys to success in this course:

1. *Attend all lectures which are critical components of this class. Attending lecture will make the difference of an entire grade.*
2. *Read the assigned text chapters/sections before coming to class.*
3. *During lectures, focus on listening to the material being presented and synthesizing this information by taking notes that summarized the key points.*

Schedule of the course

Section	Content	Date	Readings	Assignments Due
1	*Introduction to Remote Sensing*	*September 09, 2019*	*-Ch.1,3*	
2	*Image Processing/RS Applications*	*September 16, 2019*		
3	*Remote Sensing for Disaster Management*	*September 23, 2019*		*Assignment-1 due by beginning of class*
4	*Remote Sensing of Vegetation-Spectral/Temporal Characteristics, Indices, and Change Detection*	*September 30, 2019*	*-Ch.11,12*	
5	*Remote Sensing of Water, Soil, and Urban Areas*	*October 14, 2019*	*-Ch.13,14*	
6	*Students presentation*	*October 21, 2019*		
7	*Students presentation*	*October 28, 2019*		*Assignment-2 due by beginning of class*

Textbook and any related course material:

Jensen, J. R., 2007, Remote Sensing of the Environment: An Earth Resource Perspective. Prentice Hall series in Geographic information Science, NJ. (ISBN: 0-13-188950-8)

Essay Template

TITLE: ESSAY TEMPLATE FOR THE INTRODUCTION TO REMOTE SENSING COURSE (TITLE IN CAPS, 12PT BOLD CENTERED)

First Author[1,2] (10pt bold centered)

[1] *Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences, China*

[2] *Voeikov Main Geophysical Observatory, Roshydromet, Russian Federation (10pt italicized centered)*

Abstract Summary: This section should briefly summarize the main contents of your essay. Recommended length is 10 lines using Time New Roman 9pt.

Keywords: *Disaster, Flooding (9pt in italics, maximum five words)*

1. INTRODUCTION (headline in CAPITALS, 10pt Bold)

In order to have a similar format for all essays in the assignments, we are offering some recommendations to the authors for composing their essay.

The essay should be in A4 format with page margins of 25 mm on the left and right sides and 25 mm on the top and bottom. The maximum allowed length is 4 pages. Pages must not be numbered. The first page must begin with the essay title in capital letters, centered. Authors' name and affiliations must appear just below the title. A summary and keywords should directly follow.

The text should be divided in several sections, and main contents includes: 1) natural hazard and disaster mitigation in your country or region; 2) the development of remote sensing technology in your country or region; 3) your opinion on technologies that might significantly improve current disaster mitigation in your country or region, 4) challenges and recommendations of advancing disaster risk management with remote sensing technologies in your country or region.

The title of each section should be in capital letters. The text must be in a single column format. For the body, the text must be single-spaced and justified, using Times New Roman font. Font sizes are specified at various locations. It should be structured in paragraphs; each new paragraph should begin with an indent without an empty line between paragraphs. The paper should be written in English.

Tables and figures could be added in your essay. A caption must be provided for each table and figure you choose to include. Captions should be below the figures/tables and must be numbered (Tab. 1; Fig. 1).

References will appear at the end of the extended abstract. Given size constraints, only limited key references need to be included. List all citations alphabetically in the reference section. Two examples of citations are given in this document (Bougeault et al. 2001, Schwitalla et al. 2007).

Table 1 Most meaningful example of a data table with columns and lines filled with a minimum of quantitative information
(Table entries in 10pt; caption in 9pt).

Test Table	Column 1	Column 2	Column 3	Column 4
Line 01	1	2	3	4
Line 02	5	6	7	8

Line nn				

Figure 1 Two photos of polar bears. Left: Figure explanation; Right: Figure explanation (9pt)

2. NATURE HAZARDS AND DISASTER MITIGATION IN YOU COUNTRY (headline in CAPITALS, 10pt Bold)

3. REMOTE SENSING IN YOUR COUNTRY (headline in CAPITALS, 10pt Bold)

4. TECHNOLOGIES REQUIREMENT FOR… (headline in CAPITALS, 10pt Bold)

To reduce risk and vulnerability, to mitigation the effects of natural disaster, and to improve rescue operations, we must use science and technology to explore the potentially positive aspects...

5. CHALENGES AND RECOMMENDATIONS… (Headline in CAPITALS, 10pt Bold)

Provide a scientific and practical guide to Academies of Sciences, with example of good practices in implementing mitigation risk with remote sensing. ...

6. SUBMISSION OF ESSAY

The extended essay should be produced with MS-Word. **Note that if you do not submit your essay, it will not appear in the Final Scores.** Please use the following naming convention to help ease the compilation of the Volume of Essay:

```
Surname Firstname (You Student ID).doc
```

Acknowledgements: *(9pt italics)*

I thank all …

REFERENCES (in 9pt; second line indented for better distinction)

Bougeault, P., P, Binder, A. Buzzi, R. Dirks, R. Houze, J. Kuettner, R. B. Smith, R. Steinacker, and H. Volkert, 2001: the MAP Special Observing Period. *Bull. Amer. Meteorol. Soc.* **82**, 433-462.

Schwitalla, T., G. Zangl, H. S. Bauer, and V. Wulfineyer, 2007: Convective initiation in the Black Forest region in high-resolution MM5 simulations. *Proc. 29th Intern. Conf. on Alpine Meterology*, Chambery, France, 261-264.

Course title

Earth System Science Part II-Earth System Dynamics

Instructor(s)-in-charge:

Prof. JIA Gensuo

Course type:

Lecture

Course Schedule:

Once a week from November 04 to December23, 2019

Course Assessment:

Homework: 4 assignments

Grading Policy:

The grading for this course will be based on:

- Participation (30% of grade)
- Assignments (40% of grade)
-Comprehensive final exam (30% of grade)

Course Prerequisites:

Preferred but not required: Ecology, environmental sciences, climate science

Catalog Description:

This course focuses on patterns and variability of the Earth system. It addresses a number of fundamental science questions. How does the Earth system operate in the absence of significant human influence? How do human-driven processes shape land surface and climate system as addition to those due to natural variability? What are the implications of global change for human well-being? How robust is the Earth System in the face of natural and anthropogenic changes? The course covers various aspects of our scientific knowledge about the nature of the Earth system and global environmental change, and includes the following sections: 1) Spatial patterns and temporal variability of the Earth system; 2) Heterogeneity and connectivity of the Earth system; 3) Human dominated changes in global environment; 4) Land surface and terrestrial ecosystem processes; 5) Interactive changes of land-use, ecosystem, and climate; 6) Disaster risks under changing climate; 7) Earth observation of global environmental change. To encourage involvement and interaction, international students will also be given opportunity to discuss ways towards a sustainable Earth system with their local, national, and regional perspectives at a well-designed science-policy forum.

Schedule of the course

section	content	hours	Date
1	Spatial patterns and temporal variability of the Earth system	4	November 04
2	Heterogeneity and connectivity of the Earth system	4	November 11
3	Human dominated changes in global environment	4	November 18
4	Land surface and terrestrial ecosystem processes	4	November 25
5	Interactive changes of land-use, ecosystem, and climate	4	December 02
6	Disaster risks under changing climate	4	December 09

7	Earth observation of global environmental change	4	December 16
8	Science-policy forum: towards a sustainable Earth system	4	December 23
total		32	

Textbook and any related course material:
Steffen, W., A. Sanderson. P.D. Tyson, et al. 2004
Global Change and the Earth System
Springer. 336 pp

Shugart, H.H. and F.I. Woodward. 2011.
Global Change and the Terrestrial Biosphere: Achievements and Challenges,
Wiley-Blackwell Press, Oxford. 242 pp

Relevant science journals:
http://green.tea.ac.cn/Journals.html

Global and Planetary Change, 0921-8181
Global Change Biology, 1354-1013
Global Ecology and Biogeography, 0960-7447
Global Environmental Change - Human and Policy Dimensions, 0959-3780
Remote Sensing of Environment, 0034-4257

Course title

Introduction to Geodynamics

Instructor(s)-in-charge:

Prof. WANG Shimin

Course type:

Lecture

Course Schedule:

4hrs/week by instructor.

Course Assignments:

Homework: 8 assignments

Grading Policy:

20% class attendance, 40% homework, 40% final report.

Course Prerequisites:

Calculus, general physics

Catalog Description:

This course will introduce the field of geodynamics, the study of dynamical processes of the solid Earth. As such, it is rooted in fundamental physics and highly interdisciplinary. Mathematics is the central tool used to apply physical theories and create predictive models of the Earth. Geodynamics provides the quantitative foundation for the theory of Plate Tectonics, the basic organizing paradigm for our understanding of the solid Earth.

Schedule of the course

section	content	hours	Date
1	Plate tectonics	8	September 12 September 19
2	Stress and strain in solids	4	September 26
3	Elasticity and flexure	4	October 10
4	Heat transfer	8	October 17 October 24
5	Gravity	4	October 31
6	Fluid mechanics	8	November 7 November 14
7	Rock rheology	4	November 21
8	Faulting	4	November 28
9	Flows in porous media	4	December 5
total		48	

Contents of the course

Section 1: Plate tectonics

1. Origin of the theory of plate tectonics
2. Types of plate boundary
3. Plate motion models
4. Comparative Planetology

Section 2: Stress and strain in solids

5. Concepts of stress and strain

6. Measurements of crustal stress and strain

Section 3: Elasticity and flexure

7. Linear elasticity
8. Thin plate bending and applications to lithospheric flexure
9. Thickness of elastic lithosphere

Section 4: Heat transfer

10. Heat transfer in solid earth
11. Heat conduction and Fourier's law
12. Thermal structure of lithosphere
13. Thermal structure of mantle

Section 5: Gravity

14. Fundamentals of gravity
15. Gravity anomalies

Section 6: Fluid mechanics

16. Solutions to simple fluid flow problems and applications in geosciences
17. Stokes flows and mantle plume modeling
18. Thermal convection
19. Simple models for mantle convection

Section 7: Rock rheology

20. Microscopic mechanisms for rock rheology
21. Rock viscosity
22. Rock viscoelasticity and plasticity

Section 8: Faulting

23. Types of faulting
24. Frictional laws for faulting
25. Fault elastic rebound and earthquake
26. Solutions to simple faulting problems

Section 9: Flows in porous media

27. Darcy's law
28. Solutions to porous flows
29. Thermal convection in porous media

Textbook:

Geodynamics, D.L. Turcotte & J. Schubert, 3rd Edition, Cambridge University Press, 2014.

Course title

Materials Production and Environmental Sciences

Credits: 4

Instructor(s)-in-charge:

Prof. Hao Du

Course type:

Lecture

Course Schedule:

Listed in the table below.

Course Assessment:

Homework: 10 assignments, will be given after each class, extensive literature reading is expected.

Grading Policy:

Assignments 40%, Final 20%, Presentation 20%, Attendance 20%

Course Prerequisites:

College Chemistry, College Mathematics, English.

Catalog Description:

This course includes two sections. First, the introduction of different processes to recover some of the more important industrial materials; Second, introduction of the environmental issues involved in different metal recovery processes, and the methods for the pollution control. Emphasis will also be given to the clean production related to industry application.

It is expected that after taking this course, students will be familiar with most common metallic materials production processes and environmental issues related.

Schedule of the course

section	content	hours	Date
1	Overview	4	September 9
2	Steel	4	September 16
3	Aluminum	4	September 23
4	Titanium	4	September 30
5	Vanadium	4	October 14
6	Gold	4	October 21
7	Copper	4	October 28
8	Chromium and manganese	4	November 4
9	Zinc and lead	4	November 11
10	Phosphorus and potassium	4	November 18
11	Rare earth metals	4	November 25
12	Lithium	4	December 2
13	Spent battery and E-waste recovery	4	December 9
14	Student presentation	4	December 16
15	Summary and highlights	4	December 23
total		60	

Contents of the course

Textbook and any related course material:

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

Course title

Multiphase Reactor Theory and Analysis

Credits: 4

Instructor(s)-in-charge:

Prof. Xiaoxing Liu, Associate Professor Bona Lu

Course type:

Lecture

Course Schedule:

From Sep. 6 to Dec. 20, fourteen times.

Course Assessment:

Homework: 8 assignments

Grading Policy:

Typically 40% attendance, 30% homework, 30% final.

Course Prerequisites:

Be familiar with the basic knowledge of multi-phase (gas, liquid, solid) system and transport phenomena.

Catalog Description:

Reactors involving multiphase flow (gas-liquid, gas-solid, liquid-solid, gas-liquid-solid) are commonly encountered in a variety of chemical engineering processes. For the proper design, operation and optimization of chemical reactors handling multiphase flows, it is critical to get a basic understanding of the hydrodynamic, mass- and thermal transfer, and reaction characteristics of multi-phase systems. This course will be started with basic knowledge of chemical reaction theory, followed by a general introduction of the characterization and classifications of multi-phase flow phenomena. The heaviest parts of this course will be contributed to the introduction of the hydrodynamic, mixing and heat transfer phenomena occurred in the gas-solid fluidized bed reactors, the related measurement techniques and instrumentation, and typical applications of fluidized bed reactors. Technologies of numerical modelling of multiphase reactors will also be addressed and discussed.

Schedule of the course

section	content	Hours
1	Mole balances and conversion	4
2	Rate laws	4
3	Preliminary Reactor design	4
4	Distribution of residence time	4
5	Gas-solid Fluidized Bed---A General Review	4
6	General introduce of powder/granular assembly	4
7	particle characterization and fluid (particle)-particle interaction	4

8	Dense Fluidization 1	4
9	Dense fluidization 2	4
10	CFB & Design Criteria	4
11	Mass and heat transfer	4
12	Application of Fluidization Bed Reactors	4
13	Numerical simulations of multiphase reactors 1	4
14	Numerical simulations of multiphase reactors 2	4
total		56

Textbook and any related course material:

Fogler H. Scott, Elements of Chemical Reaction Engineering (Fourth edition), 2006
Fan Liang-Shi, Zhu Chao, Principles of gas-solid flows, 1998
Kunii, D., Levenspiel, O. Fluidization Engineering. Butterworth-Heinemann. 1991.
Davidson, J. F., Harrison, D. Fluidization. Academic Press. 1971.
Kwauk, M. Fast Fluidization. Advances in Chemical Engineering Vol. 20., Academic Press. 1994.
Grace, J. et al. Fluidized Beds. Multiphase Flow Handbook. Taylor & Francis. 2006.
Some materials are selected and cited from latest journal papers.

Course title

Environmental Chemistry

Instructor(s)-in-charge:

Prof. TIAN Zhen-Yu

Course type:

Lecture

Course Schedule:

Listed in the table below.

Course Assessment:

Homework: 10 assignments

Grading Policy:

Assignments 40%, Final 40%, Attendance 20%

Course Prerequisites:

Familiar with the basic knowledge of college chemistry and college mathematics.

Catalog Description:

This course offers an introduction to chemical principles and concepts and applies them to relevant environmental situations and issues. The topics include introduction to environmental science, technology, and chemistry, basic chemical concepts; the chemistry of the atmosphere and its pollution; toxicological chemistry of chemical substances; aquatic chemistry; geosphere and geochemistry; soil environmental chemistry; principles of industrial ecology. It is expected that after taking this course, students will be familiar with basic chemistry principles on environmental science, technology and chemistry.

Schedule of the course

section	content	hours	Date
1	Introduction of environmental science	4	Sep. 10 morning
2	Advanced chemical concepts: energy, entropy and rates of reaction	4	Sep. 17 morning
3	Toxicological chemistry of chemical substances	4	Sep. 24 morning
4	Environmental chemical analysis	4	Oct. 8 morning
5	Atmospheric chemistry I: energy transfer, particles	4	Oct. 15 morning
6	Atmospheric chemistry II: pollutants, smog	4	Oct. 22 morning
7	Air and gas analysis	4	Oct. 29 morning
8	Chemical analysis of water and waste water	4	Nov. 5 morning
9	Oxidation and reduction	4	Nov. 12 morning
10	The geosphere and geochemistry	4	Nov. 19 morning
11	Aquatic chemistry	4	Nov. 26 morning
12	Geosphere and geochemistry	4	Dec. 3 morning
13	Soil Environmental chemistry	4	Dec. 10 morning
14	Principles of industrial ecology	4	Dec. 17 morning
15	Presentation and examination	4	Dec. 24 morning
Total		**60**	

Contents of the course

Section 1: Environmental Science, technology and chemistry

1. What is Environmental Science
2. Some basic chemical concepts
3. Atmospheric chemistry

Section 2: Environmental chemical analysis

4. The anthrosphere, industrial ecosystems, and environmental chemistry
5. Fundamentals of aquatic chemistry
6. Oxidation and reduction
7. Phase interactions
8. Aquatic microbial biochemistry
9. Water pollution
10. Water treatment
11. The atmosphere and atmospheric chemistry
12. Particles in the atmosphere
13. Gaseous inorganic air pollutants
14. Organic air pollutants
15. Photochemical smog
16. The geosphere and geochemistry
17. Soil Environmental chemistry

Textbook and any related course material:
1) John Wright, Environmental Chemistry, Routledge, 2003.
2) Stanley E. Manahan, Environmental Chemistry, CRC Press LLC, 2000.
3) H.J.M. Bowen, Environmental Chemistry Volume 2, Royal Society of Chemistry, 2010.

Expected level of proficiency from students entering the course:
Mathematics: college mathematics
Chemistry: college chemistry

Course title

Advanced Diagnostic Technologies of Chemical Reactions and Its Application

Instructor(s)-in-charge:

Prof. TIAN Zhen-Yu

Course type:

Lecture

Course Schedule:

Listed in the table below.

Course Assessment:

Homework: 10 assignments

Grading Policy:

Assignments 40%, Final 40%, Attendance 20%

Course Prerequisites:

Familiar with the basic knowledge of college chemistry and college mathematics.

Catalog Description:

The course is mainly focusing on the principles of advanced diagnostics in the homogeneous and heterogeneous chemical reactions, particularly the applications of these diagnostic methods in the chemical and environmental field will be introduced. In detail, this course will be started with spectrophotometric methods, electrochemical methods of analysis, chromatography and mass spectrometry, following by their application in gas-, liquid- and surface reactions. Moreover, theoretical calculations and kinetic modeling will be also introduced to further improve the understanding the homogeneous and heterogeneous reactions.

Schedule of the course

section	content	hours	Date
1	Introduction of the diagnostic technologies	4	Sep. 10 afternoon
2	Reactors	4	Sep. 17 afternoon
3	Classical methods	4	Sep. 24 afternoon
4	Spectrophotometric methods I	4	Oct. 8 afternoon
5	Spectrophotometric methods II	4	Oct. 15 afternoon
6	Electrochemical methods of analysis	4	Oct. 22 afternoon
7	Chromatography	4	Oct. 29 afternoon
8	Mass spectrometry I	4	Nov. 5 afternoon
9	Mass spectrometry II	4	Nov. 12 afternoon
10	Air and gas analysis	4	Nov. 19 afternoon
11	Chemical analysis of liquid-phase reactions	4	Nov. 26 afternoon
12	Diagnostic analysis of surface reactions	4	Dec. 3 afternoon
13	Coupling with theoretical calculations	4	Dec. 10 afternoon
14	Comparison with modeling results	4	Dec. 17 afternoon
15	Presentation and examination	4	Dec. 24 afternoon
Total		**60**	

Contents of the course

Section 1: Diagnostic technologies

1. Introduction of the diagnostic technologies
2. Classical methods
3. Spectrophotometric methods
4. Electrochemical methods of analysis

5. Chromatography
6. Mass spectrometry

Section 2: Applications in homogeneous and heterogeneous systems

7. Gas-phase reactions
8. Liquid-phase reactions
9. Surface reactions
10. Coupling with theoretical calculations
11. Comparison with modeling results

Textbook and any related course material:

1) Robert J. Cotter, Time of flight mass spectrometry, Washington, DC, 1993.
2) Stanley E. Manahan, Environmental Chemistry, CRC Press LLC, 2000.

Expected level of proficiency from students entering the course:

Chemistry: college chemistry

Course title

Geographic Information Systems

Instructor(s)-in-charge:

Class 1-Prof. SONG Xianfeng, Dr. SONG Ci and Dr. YI Jiawei

Class 2-Prof. ZHOU Xiang, Dr. TAO Zui, Dr. LI Hongga and Dr. LV Tingting

Course type:

Lecture

Course Schedule:

4hrs/week by instructor

Course Assessment:

Homework: 3 assignments

Grading Policy:

Typically 50% homework, 50% final.

Course Prerequisites:

Introductory courses related to geography, environmental sciences, and cartography.

Catalog Description:

This course includes two parts - lectures and laboratory practice. The lectures introduce the methods of managing and processing geospatial data, and cover the topics of coordinate systems, spatial data models and structures, spatial analysis, and GIS models and modeling. The laboratory practice is designed to help students to master a GIS software (i.e. ArcGIS desktop or QGIS) by a number of experiences on data management, data analysis, GIS modeling, and result presentation.

Schedule of the course

chapter	content	hours
1-2	Nature of Geographic data Coordinate Systems	4
3-4	Geo-data Organization (vector, raster, tin, …)	4
5-6	Spatial Data Acquisition Geometric Transformation	4
7-9	Attribute Data Management Cartography and GIS Mapping	8
	Homework 1	
10	Data Exploration	4
11	Vector Data Analysis	4
12	Raster Data Analysis	4
13-14	Terrain, Viewshed and Watershed Analysis	4
	Homework 2	
15	Spatial Interpolation	4
16	Least Cost Path and Network Analysis	4
17	GIS Models and Modeling	4
	Homework 3	
18	Exam	4

Total		52

Contents of the course

Section 1: Conceptual Frameworks for GIS

1 Nature of Geographic data
2 Coordinate Systems
3 Vector Data Model
4 Raster Data Model

Section 2: Spatial Data Management

5 GIS Data Acquisition
6 Geometric Transformation
7 Spatial Data Accuracy and Quality
8 Attribute Data Management
9 Data Display and Cartography

Section 3: Spatial Analysis

10 Data Exploration
11 Vector Data Analysis
12 Raster Data Analysis
13 Terrain Mapping and Analysis
14 Viewshed and Watershed Analysis
15 Spatial Interpolation
16 Least Cost Path and Network Analysis

Section 4: GIS Modeling

17 GIS Models and Modeling

Textbook and any related course material:

Introduction to Geographic Information Systems, 8th Edition, 2016
Edited by Kang-tsung Chang.
Geospatial Analysis: a comprehensive guide to principles, techniques and software tools, 6th Edition, 2018
http://www.spatialanalysisonline.com/HTML/index.html
Edited by Michael J de Smith, Michael F Goodchild, Paul A longley
Geospatial Analysis: a comprehensive guide to principles, techniques and software tools), 3rd Edition, 2007
Edited by Michael J de Smith, Michael F Goodchild, Paul A longley

Expected level of proficiency from students entering the course:

Geosciences: strong
Computer Sciences: middle

Course title

Advanced Quantum Mechanics

Credits: 3

Instructor(s)-in-charge:

Prof. Cong-Feng Qiao

Course type:

Lecture

Course Schedule:

From Oct.30 to Dec.18， Wednesday and Friday evenings, ***6 hrs*** *per week.*
Classtime: 19:00-21:40
Oct.30, Nov.1, Nov.6, Nov.8, Nov. 13, Nov.15, Nov.20, Nov.22, Nov.27, Nov.29, Dec.4, Dec.6, Dec. 11, Dec.13, Dec.18

Course Assessment:

Homework: ***12+*** *assignments.*

Grading Policy:

Total score includes ***40%*** *homework,* ***40%*** *class test,* ***20%*** *final exam.*

Course Prerequisites:

Undergraduate degree in physics(BS) or equivalent.

Catalog Description:

This course includes four chapters plus two operational chapters of the Textbook: J. J. Sakurai and J. Napolitano, Modern Quantum Mechanisc, 2nd edition (Addison – Wesley), (2010)
Chapters:1）Fundamental Concepts；2）Quantum Dynamics；3）Theory of Angular Momentum；4）Approximation Methods；5*）Scattering Theory；6）Relativistic Quantum Mechanics. Note: * for selective contents*

Schedule of the course

section	*content*	*hours*
1	*(b)*	*3*
1	*(c)*	*3*
2	*(b)*	*3*
2	*(c)*	*3*
2	*(d)*	*3*
2	*(e)*	*3*
3	*(a)*	*3*
3	*(b)*	*3*
3	*(d)*	*3*
3	*(f)*	*3*
6	*(a)*	*3*
6	*(b)*	*3*
6	*(c)*	*3*
review	*And also selected topics*	*3*
test		*3*
total		*45*

Contents of the course

Section 1:

1. Fundamental Concepts

(a) Stern-Gerlach Experiments

(b) Physical States, Observables, Uncertainty Relation, and Measurement

(c) Wave Functions in Position and Momentum Space

Supplement-Linear Algebra

Section 2:

2. Quantum Dynamics

(a) Time Evolution and Schrodinger Equation

(b) Schrodinger Picture and Heidenberg Picture

(c) Simple Harmonic Oscillator

(d) Schrodinger's wave equation

(e) Elementary Solutions to Schrodinger’s Wave Equation

Section 3:

3. Theory of Angular Momentum

(a) Rotation and Angular Momentum Commutation Relation

(b) Spin 1/2 and Finite Rotation

(c) Density Operator and Pure verse Mixed Ensembles

(d) Eigenvalue and Eigenvectors of Angular momentum

(e) Orbital Angular momentum

(f) Addition of Angular momenta

Section 4:

4. Approximation Methods

(a) Symmetries, Conservation Laws, and Degeneracies

(b) Discrete Symmetries, Parity, or Space Inversion

(c) The Time-Reversal Discrete Symmetry

Section 5:

5. Approximation Methods

(a) Time-independent Perturbation Theory: Nondegenerate Case

(b) Time-independent Perturbation Theory: The Degenerate Case

(c) Hydrogen-Like Atoms: Fine structure the Zeeman Effect

(d) Variational Methods

Section 6:

6. Relativistic Quantum Mechanics

(a) Paths to Relativistic Quantum Mechanics

(b) The Dirac Equation

(c) Symmetries of the Dirac Equation

Course title

Data Science

Instructor(s)-in-charge:

Prof. Tiejian Luo

Course type:

Lecture, Seminar

Course Schedule:

4hrs/week by instructor. 60hrs in total.

Course Assessment:

Homework: 3 assignments and 1 project

Grading Policy:

Typically 60% homework, 40% project.

Course Prerequisites:

Discrete Mathematics

Catalog Description:

This course is a professional seminar for graduate students in computer software and theory. Its purpose is to enable students to master the basic content of network science and understand its application fields. This course focuses on the common models of network science. The requirements for students are follows: Master the basic methods of network science including common models and algorithms; Master the main ideas of network modeling and network behavior analysis. This course enables computer graduate students to deeply grasp the scientific research trends in the direction of network science, the latest technology, and have a preliminary understanding of the application of different fields of network science. It is supposed to cultivate the research learning ability of graduate students, broaden their horizons, and lay a solid foundation for future research and application.

Schedule of the course

section	content	hours
1	Introduction to Network Science	6
2	Basic concepts of network science	6
3	Main Issues in Network Science	6
4	Discussion on the research direction of network science	6
5	Network Communication Model in Network Science	6
6	Exercise Class	6
7	Project Presentation	6
8	Project Presentation	6
9	Project Presentation	6
10	Project Presentation	6
total		60

Contents of the course

Topic 1: Introduction to Network Science
Basic concepts, development history, role and impact of network science

Topic 2: Basic concepts of network science
Graph representation of the network, computer representation of the graph, path and connectivity, spanning tree and minimum spanning tree, bipartite graph and matching problem network topology properties (node degree, average path length, clustering coefficient, degree distribution, power law distribution)

Topic 3: Main Issues in Network Science
Network science focuses on the scientific understanding of the quantitative and qualitative characteristics of complex networks. (1) structural complexity, (2) node complexity, (3) interaction between structure and nodes, and (4) interaction between networks.

Topic 4: Discussion on the research direction of network science
Reveal and describe the topological properties of network systems and the appropriate methods to measure these properties; establish network models to help people understand the meaning and mechanism of these statistical properties; predict network behavior based on the nature of individual nodes and the structural nature of the entire network; Effective methods to improve existing network performance and design new networks is proposed.

Topic 5: Network Communication Model in Network Science
Contagion model, propagation threshold analysis, communication impact analysis, complex network immunization strategies, etc.

Textbook and any related course material:

Hongsong, Chen. Networks, Crowds, and Markets: Reasoning about a Highly Connected World ,Easley, D. and Kleinberg, J., 2010

Stanford University：Analysis of Networks MINING AND LEARNING WITH GRAPHS, Stanford

Cornell University：The Structure of Information Networks, Jon Kleinberg

University of Southern California：Structure and Dynamics of Networked Information, David Kempe

University of Helsinki：Information Networks, Panayiotis Tsaparas

Course title

Advanced Software Engineering

Instructor(s)-in-charge:

Prof. Tiejian Luo

Course type:

Lecture

Course Schedule:

4hrs/week by instructor. 60hrs in total.

Course Assessment:

Homework: 2 assignments and 1 project

Grading Policy:

Typically 60% homework, 40% project.

Course Prerequisites:

Data Structure, Database, Software Engineering

Catalog Description:

This course is a basic course for graduate students in computer science and technology. This course focuses on the new issues facing software engineering today and the development of new technologies to address these issues, including requirements engineering, software design, software processes, and software quality. Through this course, students will be able to fully understand the latest developments in software engineering today and enhance the ability to design actual systems.

Schedule of the course

section	content	hours
1	Software Engineering Foundation	2
2	Software Process	6
3	Software Project Management	6
4	Software Requirements Engineering	6
5	Software Design Fundamentals	6
6	Software Development Technology	6
7	Software Testing	6
8	Software Evolution	6
9	Software Reliability Technology	6
10	Project Presentation	10
total		60

Contents of the course

Chapter 1 Software Engineering Foundation (Introduce the concept and development process of software engineering concepts, analyze the nature of software development, and introduce the organizational content structure of this course around the nature of software development);

Chapter 2 Software Process (The concept of software process model, software life cycle model, such as waterfall model, spiral model, agile development model, etc.);

Chapter 3 Software Project Management (software project management basic

concepts, project personnel and organization, product quality assurance, project management process and content, familiar with the project management process and related tools through curriculum practice, create curriculum practice projects);
Chapter 4 Software Requirements Engineering (Basic Concepts of Software Requirements, Software Requirements Engineering Processes and Methods, Software Requirements Models and Requirements Specification);
Chapter 5: Software Design Fundamentals (Basic Concepts and Principles of Software Design, Software Structure and Behavior Models, Software Architecture Concepts and Models, Software Architecture Design, Object-Oriented Design Methods, and UML);
Chapter 6 Software Development Technology (Agile Software Development Method, Software Reuse, Design Pattern, Application Framework, Component-Based Software Development Method);
Chapter 7 Software Testing (Software Verification and Validation, Software Testing Basics, Software Testing Types, Software Testing Activities, Software Testing Automation, Software Reliability Verification and Protection);
Chapter 8 Software Evolution (the goal and type of software maintenance, software maintenance process, legacy system evolution technology);
Chapter 9 Software Reliability Technology (Introduction to Formal Methods, Formal Language, Software Reliability Concepts and Challenges, Software Fault Tolerance Techniques)

Textbook and any related course material:

Armando Fox, and David Patternson, Engineering software as a service, 1st edition, Strawberry Canyon LLC

Course title

Remote Sensing Image Processing

Instructor(s)-in-charge:

Prof. JIANG Xiaoguang, Dr. HU Ronghai and Dr. JIang Yazheng

Course type:

Lecture

Course Schedule:

4hrs/week by instructor

Course Assessment:

Homework: 3 assignments

Grading Policy:

Typically 50% homework, 50% final exam.

Course Prerequisites:

Introductory courses related to geography and remote sensing.

Catalog Description:

Combining theory with practice, this course includes two interrelated parts - lectures and laboratory practice. The lectures introduce the basic principles and methods of remote sensing technology and image processing briefly. The laboratory practice is the key points of the course, it is designed to help students to master the remote sensing image analysis software ENVI by a number of experiences on image processing, image management and image analysis.

Schedule of the course

chapter	content	hours	Date
1-2	Remote Sensing overview Introduction to ENVI	4	Sept.10
3-4	Image Display and Management Coordinate Systems	4	Sept.17
5-6	Image Subset Image Registration	4	Sept.24
7-8	Image Geometric Correction Image Mosaicking	4	Oct.8
	Homework 1		
9-10	Image Registration Workflow Image Orthorectification	4	Oct.15
11-12	Band Math Image Fusion	4	Oct.22
13-14	Image Supervised Classification Image Unsupervised Classification	4	Oct.29
15-16	Image Classification with Decision Tree Classifier Post Classification	4	Nov.5
	Homework 2		
17-18	Radiometric Calibration Atmospheric Correction	4	Nov.12

19-20	Vegetation Analysis Spectral Analysis	4	Nov.19
21-22	Terrain Analysis and Visualization DEM extraction of Stereo Tie Points	4	Nov.26
23-24	Spatial Change Analysis Temporal Change Analysis	4	Dec.3
	Homework 3		
	Exam	4	Dec.10
Total		52	

Contents of the course

Section 1: The Basic Operation of Image

1 Remote Sensing overview
2 Introduction to ENVI
3 Image Display and Management
4 Coordinate Systems
5 Image Subset

Section 2: Image Registration and Geometric Correction

6 Image Registration
7 Image Geometric Correction
8 Image Mosaicking
9 Image Registration Workflow
10 Image Orthorectification

Section 3: Band Math and Image Fusion

11 Band Math
12 Image Fusion

Section 4: Image Classification

13 Image Supervised Classification
14 Image Unsupervised Classification
15 Image Classification with Decision Tree Classifier
16 Post Classification

Section 5: Radiometric Correction

17 Radiometric Calibration
18 Atmospheric Correction

Section 6: Vegetation Analysis and Spectral Analysis

19 Vegetation Analysis
20 Spectral Analysis

Section7: Terrain Analysis

21 Terrain Analysis and Visualization
22 DEM extraction of Stereo Tie Points

Section8: Remote Sensing Dynamic Monitoring

23 Spatial Change Analysis
24 Temporal Change Analysis

Textbook and any related course material:
Introduction to ENVI Analytics, Revised for Print January, 2016
ENVI User's Guide

Expected level of proficiency from students entering the course:
Remote Sensing: strong
Geosciences: middle
Computer Sciences: middle

Course title

Fundamentals and Frontier of Materials Science

Instructor(s)-in-charge:

Prof. Zhang, Guangjin,
Prof. Han Yongsheng
Prof. Yang Jun

Course type:

Lecture

Course Assessment:

Homework: 10 assignments, presentations

Grading Policy:

Assignments 40%, Final 40%, Attendance 20%

Course Prerequisites:

The basic knowledge of materials science, chemistry, crystallization.

Catalog Description:

The purpose of this course includes: Introduction to the fundamental knowledge of materials science, increase the interest to materials science, extend scope of knowledge. Knowing the basic knowledge of materials science, the basic theories, frontier and developments; Getting the ideas on how to develop function materials and can apply the learned knowledge in your further research works. The topics include basic principles of material chemistry and physics, metal materials, crystalline materials, semiconductor materials, carbon materials, porous materials, soft materials, organic materials, ceramic materials, catalytic materials…. .

Schedule of the course

section	content	hours
1	Materials Science: a general review	4
2	Materials chemistry and physics	4
3	Metal materials	4
4	Crystalline materials	4
5	Carbon materials	4
6	Semiconductor materials	4
7	Soft materials	4
8	Ceramic materials	4
9	Catalytic materials	4
10	Structured materials?	4
11	Kinetics in materials synthesis	4
12	Thermodynamics in materials synthesis	4
13	Crystallization	4
14	Mesoscience in materials	4
15	Examination	4
Total		**60**

Course title

MATLAB with Applications to Mathematics, Science, Engineering, and Finance

Instructor(s)-in-charge:

Dr. LUO CUI CUI

Course type:

Lecture

Course Schedule:

3hrs/week by instructor, 1 hr/week by teaching assistant（45 hours in total）.

Course Assessment:

Homework: 2 assignments, 1 final project

Grading Policy:

Attendance: 15%, Homework: 30%, Project: 30%, Final examination: 25%

Course Prerequisites:

Calculus, Linear Algebra, Probability and Statistics

Catalog Description:

This course studies the design, implementation and use of computer programs to solve practical mathematical problems of relevance to health, biology, finance and risk management. This course will help develop your quantitative skills and ability to reason logically and mathematically and apply these skills to problems of relevance to social sciences. It emphasizes the importance of understanding the underlying mathematics, computational techniques and problems solving skills.

Schedule of the course

section	content	hours	Date
1	Introduction to MATLAB and Basic Data Types	3	September 10
2	Graphical Displays of Data and Data Interpolation	3	September 17
3	Matrices and Linear Regression	3	September 24
4	Optimization with MATLAB	6	October 8 October 15
5	MATLAB Applications to Statistics	9	October 22 October 29 November 5
6	MATLAB Applications to Finance	9	November 12 November 19 November 26
7	Machine Learning with MATLAB	6	December 3 December 10
8	Student presentation	3	December 17
9	Final Exam	3	December 24
total		45	

Contents of the course

Section 1: Introduction to MATLAB and Basic Data Types

1. Introduction to MATLAB
2. Basic data types and operators

Section 2: Graphical Displays of Data and Data Interpolation

4. Plotting with MATLAB
5. Data Interpolation

Section 3: Matrices and Linear Regression

1. Matrices and linear algebra
2. Linear Regression

Section 4: Optimization with MATLAB

1. Linear programming and mixed-integer linear programming
2. Quadratic programming
3. Unconstrained nonlinear programming

Section 5: MATLAB Applications to Statistics

1. Basic probabilities and descriptive data analysis
2. Time series and its main characteristics
3. Stationary and non-stationary time series
4. Univariate time models: Autoregressive-moving average models (ARMA), ARIMA
5. Multivariate time series: Vector autoregression (VAR), Co-integration

Section 6: MATLAB Applications to Finance

1. Weiner processes, stochastic differential equations, stochastic integrals
2. Option pricing: Black–Scholes formula, PDE
3. Monte-Carlo methods
4. Stochastic volatility, ARCH and GARCH models, EWMA
5. Fixed income

Section 7: Machine Learning with MATLAB

1. Supervised and unsupervised machine learning algorithms, including support vector machines (SVMs), boosted and bagged decision trees, k-nearest neighbor, k-means, Gaussian mixture models, and hidden Markov models

Textbook and any related course material:

MATLAB help, https://www.mathworks.com/help/
Textbooks: MATLAB Handbook with Applications to Mathematics, Science, Engineering, and Finance 1st Edition by Jose Miguel David Baez-Lopez, David Alfredo Baez Villegas

Expected level of proficiency from students entering the course:

Mathematics: moderate
Statisticss: moderate

Course title

Scientific Writing

Objectives

For graduate students, writing academic papers in English not only means a fundamental skill in their academic study, but also symbolizes their professional development and achievement. Grounded on the common difficulties and challenges that science students may encounter in their academic writing, the aim of this course is to help them understand academic papers' style, guidelines, and writing methods, improve their language accuracy in academic contexts, and therefore, improve their confidence and capacity in academic English writing.

Main Contents

This course is designed as a series of 4-hour lectures, 12 lectures in total for the present course syllabus. The topics of these lectures range from stylistic features of academic papers to abstract writing, to approaches of integrating outside sources, to visual information, to cohesive devices, and to how to make academic presentation.

Teaching Approaches

Class instruction

Textbooks and Reference Books

1. Grace Canseco. Inside Academic Writing: Understanding Audience and Becoming Part of an Academic Community, Ann Arbor University of Michigan Press, 2010.
2. Robert A. Day and Barbara Gastel. How to Write and Publish a Scientific Paper (Sixth Edition), Peking University Press, 2012.
3. John M. Swales and Christine B. Feak. Academic Writing for Graduate Students: Essential Tasks and Skills (3rd Edition), University of Michigan Press, 2012.

Course title

Public Speaking

Instructor(s)-in-charge:

Associate Prof. Meng Yanli

Course type:

Lecture and seminar combined

Course Schedule:

4hrs/week by instructor

Course Assessment:

Assignment and Public speeches made by students

Grading Policy:

10% Attendence, 10% assignment, 20% introductory speech,30% informative speech, 30% persuasive speech.

Course Prerequisites:

No

Catalog Description:

The purpose of this course is to improve your skills of writing and presenting effective public speeches, with special emphasis on informative and persuasive discourse. The principles you learn in this class will benefit you not only in subsequent courses, but also in your career and in your life as a citizen in a global age. The course will introduce major principles and strategies in speech-making, including choosing a topic, audience analysis, supporting your idea, orgazing the main points, beginning and ending your speech, using visual aids, language rhetorics, and so on. The charm of the class includes the use of a large amount of excellent speeches as samples for analysis and the encouragement for student practice and participation.

Schedule of the course

section	content	hours	Date
1	Introduction to public speaking	4	Oct.8
2	Giving your first speech Introductory speech	4	Oct.15
3	Selecting a topic and a purpose Analyzing the audience	4	Oct.22
4	Supporting your ideas Outlining the speech	4	Oct.29
5	Organizing the body the the speech	4	Nov.5
6	Beginning and ending the speech	4	Nov.12
7	Using language	4	Nov.19
8	Delivering the speech Using visual aids	4	Nov.26
9	Speaking to inform	4	Dec.3
10	Presentation of informative speeches	4	Dec.10
11	Speaking to persuade	4	Dec.17

12	Presentation of persuasive speeches	4	Dec.24
total		48	

Contents of the course

Session 1: Overview of public speaking

1. Course overview
2. Icebreaker activity
3. Basic principles of public speaking

Session 2: Giving your first speech

1. Speaking confidently and ethically
2. Presentation of introductory speeches
3. Comments and discussion

Session 3: Selecting a topic and a purpose and analyzing the audience

1. Selecting a topic and a purpose
2. Analyzing the audience
3. Exercise and sample analysis

Session 4: Supporting your ideas and outlining the speech

1. Types of supporting materials
2. Tips in using supporting materials in a speech
3. Drafting a speech outline for your manuscript
4. Drafting a speaking outline for your delivery
5. Exercise and sample analysis

Session 5: Organizing the body of the speech

1. The concept of strategic structure
2. Methods of organization
3. Use of connectives to smooth the progression of ideas
4. Exercise and sample analysis

Session 6: Beginning and ending the speech

1. The four objectives of an effective speech introduction
2. Tips for creating an effective speech introduction
3. The two objectives of an effective speech conclusion
4. Tips for creating an effective speech conclusion
5. Exercise and sample analysis

Session 7: Using language

1. Criteria of using English in public speaking
2. Rhetorical devices and exercises
3. Sample analysis

Session 8: Delivering the speech and using visual aids

1. Principles of effective speech delivery
2. Sample analysis and practice students' delivery skills
3. Types of visual aids
4. Tips of creating and presenting visual aids
5. Exercise and sample analysis

Session 9: Speaking to inform

1. Types of informative speeches
2. Tips for informatie speaking
3. Exercise and sample analysis

Session 10: Presentation of informative speeches

Session 11: Speaking to persuade

1. Methods of persuasion
2. Tips for persuasive speaking
3. Exercise and sample analysis

Session 12: Presentation of persuasive speeches

Textbook and any related course material:

Stephen E. Lucas. 2011. *The Art of Public Speaking.* Beijing: Foreign Language Teaching and Research Press

Expected level of proficiency from students entering the course:

English language: strong