"Principles of Chemical Engineering"
Course Syllabus

Soochow University Course Number：09041017
Course Category：Compulsory
Open to: 3rd year students in the Intensive Training Classes (both Chemistry and Engineering) and oversea students（工程强化班和化学强化班学生及留学生）
Level：Undergraduate
Semester：Spring
Credit：4 Credits
Lecture Hours：72 Hours
Instructors：Prof. Jie Xiao, Dr. Saartje Hernalsteens, A/Prof. Nan Fu, A/Prof. Na Li
Textbooks：
McCabe, W. L.; Smith, J. C.; Harriott, P. Unit Operations of Chemical Engineering, 7th Edition, McGraw-Hill, 2005 (英文改编版，伍钦等改编，化学工业出版社，2008).
http://highered.mheducation.com/sites/0072848235/information_center_view0/what_s_new.html
References：

- Bird, R. B.; Stewart, W. E.; Lightfoot, E. N. Transport Phenomena, 2nd Edition, John Wiley & Sons, Inc. 2002（影印版，化学工业出版社，2002）.
- Incropera, F. P.; Dewitt, D. P.; Bergman, T.L.; Lavine, A.S. Fundamentals of Heat and Mass Transfer, John Wiley & Sons, Inc. 2007 （影印版，化学工业出版社，2007）.
- Holman, J. P. Heat Transfer, 10th Edition, The MacGraw-Hill Companies, Inc. 2010.
- Richardson, J. F.; Harker, J. H.; Backhurst, J. R. Chemical Engineering: Separation Processes (Volume 2B), Elsevier LTD, 2008.
- Richardson, J. F.; Harker, J. H.; Backhurst, J. R. Chemical Engineering: Particle Technology (Volume 2A), Elsevier LTD, 2008.

Teaching Objectives：
Student-centered teaching approach will be promoted in this course with the objectives of stimulating students' interests and training students' capabilities.
Stimulating interests. We believe that understanding of interesting physics and beautiful math is far more important than reciting equation to do calculations. There are two major parts for this course: the theoretical part (i.e., transport theory) and the application part (i.e., unit operations). After learning this course, students will be familiar with the basic transport theories for mass, momentum and heat transfer. At the same time, they will be able to use these theories to analyze unit operation systems, such as fluid transport systems with pipes, pumps and valves, heat exchangers, drying towers, gas absorption tower, and distillation columns, etc. Furthermore, the students should be able to apply the transport theory to the analysis of the phenomenon in our daily life. In this way, they can realize how important and interesting of the theories offered in this course. At the same time, applications of the transport theories to high-level advanced research will be demonstrated, which will let students know how powerful the theories are. Hopefully, they can later use the theory to explain experimental observations in their research projects that in most cases involve mass,

momentum and heat transfer.
Capability development. The students will be trained to (1) do critical review of the literature, (2) solve problems by using what have been learned from the class, (3) write a report and present their work by carrying out one challenging and interesting project. Students' capability of critical thinking, problem-solving, effective-communication will be our focus.

Contents to be covered in this course:

Week	Contents	Hours
1	1.Concepts of chemical engineering and unit operations Unit systems and conversion of units. 2.Dimensional analysis.	4
2	1.Fluid statics and its applications. 2.Newton's law of viscosity; Basic rheology; Reynolds experiment	4
3	1.Basic equations of fluid flow: measures of flow, continuity, energy balance 2.Basic equations of fluid flow: momentum balance Laminar flow in a pipe metering of fluids	4
4	Fluid friction, the friction factor chart; Laminar flow of a non-Newtonian fluid in a circular tube Pipe flow systems	4
5	Flow past immersed objects; Introduction to heat transfer	4
6	Heat transfer by conduction; Principles of heat flow in fluids; **Quiz 1**	4
7	Convective heat transfer	4
8	Heat transfer by radiation	4
9	Heat exchangers	4
10	Summary of heat transfer; **Mid-term Exam**	4
11	Theory of diffusion	4
12	Mass-transfer theories	4
13	Equilibrium relations; Equilibrium-stage operations	4
14	Equilibrium-stage operations; Gas absorption	4
15	Gas absorption; **Quiz II (Project)**	4
16	Simple and equilibrium distillations, continuous distillation	4
17	Continuous distillation with reflux; Distillation	4
18	Review	4
	Total course hours	72

Exams and Grading：
Midterm exam and Final exam are mandatory. They will account for 60% of the total score. The other 40% will include be evaluated based on your class attendance, after-class interactions with instructors, homework, in-class quiz, and project performance.

Updated by：Prof. Jie Xiao
Date: Feb. 20, 2019

教学大纲补充内容（中文）

本课程校内发展的主要历史沿革：

2012年以前，化工原理课程在苏州大学材料与化学化工学部（材化部）是化工专业的学位课，用中文教学。自2010年起，为了培养和国际接轨的本科人才，材化部做出重要决定，从学部每年的所有新生中挑选30名左右优秀学生组成强化班，其四年本科教育的所有专业课均采用全英文教学（与在国外修读这些专业课无异）。化工原理（Principles of Chemical Engineering）便是其中一门新开设的主要专业课。每学年春学期开设，针对强化班（从化学，材料，化工与环境专业本科新生中挑选出的优秀学生）大三学生开放，为专业必修课。学生规模随着强化班的发展逐年有所增加，从2012年的18人，到2013年，2014年的20人，再到2015年的23人。2012年4月，肖杰教授从美国归国加盟苏州大学，第一届强化班学生正好到大三，化工原理全英文课程第一次在苏大讲授。当时王衍伟老师（副教授，丹麦技术大学博士，Technical University of Denmark）讲授课程前半部分，肖杰教授从5月开始接手这门课程。至今，一直负责这门课程，和傅楠副教授以及李娜副教授合作完成教学。特别是2014-2015学年，本课程入选“苏大课程2014—3I工程”全英文教学示范课程建设项目。2016年入选江苏省高校外国留学生英文授课省级精品课程，原巴西圣保罗联邦大学（the Federal University of Sao Paulo (Brazil)）的教授Saartje Hernalsteens博士加入教学团队。近几年培养出的毕业生能够用英语流利交流，阅读理解本专业的最新前沿成果的能力很强，受到国外高校，国内顶尖985高校及企事业单位的认可和欢迎。

从2015年开始，在我们化工与环境工程学院的推动下，材化部增设工程班（从化工，环境工程及材料工程本科生中选30人左右组成），强化全英文工程教育，化工原理无疑是他们最重要的专业课之一。另外，我们学院近年来吸引了一批从澳洲，欧洲，东南亚国家来的留学交流生，已经成为“新常态”，英文化工原理课程也对这些学生开放，欢迎他们参加。2016年正在讲授的此课程，班级人数达58人。之后稳定在这个规模。

课程定位，重点及难点：

英文化工原理课程针对工程强化班开设，也为外国留学交流生提供了一门英文专业课程。通过课程教学，旨在培养基础扎实、知识面广、具有全球视野的竞争力强的化学工程师。使学生能够在掌握主要化学工程基础知识的同时，了解化工学科前沿方向及发展趋势。并且激发学生的学习兴趣和热情，培养学生实际应用能力，使之具备较强的动手能力，以及运用计算机对化工系统进行模拟仿真的能力，并能够运用所学知识解决实际的工程问题。课程采用全英文授课方式，培养学生较强的英语应用能力和国际交流能力。本课程重点讲授化学工程中三传（即传动量，传热和传质）的基本原理、数学描述及相应的化工生产中的单元操作：包括流体管路，换热器，吸收塔及蒸馏塔等。课程难点在于要求学生能够做到融会贯通，有能力将课堂学到的理论知识应用到解决实际科学及工程问题中。我们授课过程中将注重启发、强调互动，希望学生能够熟练掌握牛顿粘性定律，傅立叶定律，菲克定律及其在三传现象中的应用，从而分析身边的日常生活现象，同时可以进行初步的对单元操作设备的设计和优化。

课程支撑资料：

借助苏州大学视频课程学习平台，所有讲授视频已经发布：
（请用IE打开以下链接，登陆苏大网关后，可以观看所有65个视频；可能需要更新您的Flash Player；网站暂不支持苹果操作系统）
http://opencourse.suda.edu.cn/VIEWGOOD/Pc/themes/default/Prog.aspx?id=2009

我们也建立了完整的课程网站：
（如从苏大校外访问，请先用网关登陆VPN后，在IE地址栏拷贝以下链接）
http://42.244.42.191/G2S/Template/View.aspx?action=view&courseType=1&courseId=27872&ZZWLOOKINGFOR=G