PKU Globex Julmester®

Smart Materials and Adaptive Systems (3 Credits)

智能材料与适应性系统

Instructors	**Gregory WASHINGTON** (gnwashin@uci.edu) **Farzad AHMADKHANLOU** (farzad.a@uci.edu)	Dept. of Mechanical and Aerospace Engineering University of California Irvine, USA
Synopsis	Modeling and control of smart materials to include: piezoceramics, piezopolymers, shape memory alloys, electrorheological and magnetorheological fluids. Applications to real world systems will be emphasized.	
Offering	2017 Julmester (July Semester)	
Audience	Year 3 & 4 Undergraduate and Year 1 Graduate Students	
Classroom	Room xxx, Teaching Bldg. No. XX, Peking University	
Schedule	Class: 8-11 AM, M-F, July 3–21, 2017	Total Contact Hours: 45
	Final Exam: 8-10 AM, July 22, 2017	

Objectives

- Develop macromechanical models of smart materials and relate those models to equivalent electrical energy circuits.
- Model and understand the nonlinear effects that effect smart materials
- Utilize smart materials in actuator, sensor and controlled materials design
- Apply smart materials to practical engineering systems

Topics

Class Organization, Introduction and Overview of Smart Materials

- Mathematical preliminaries (notation)
- Matrix and tensor mathematics
- General constitutive modeling

Electrorheological Fluids and Magnetorheological Fluids

- What are ER/MR Fluids
- ER/MR Fluid Dashpot Dampers
- Newtonian shear flow, Bingham plastic shear flow, Rectangular Duct Analysis
- Design with ER/MR Fluids

Piezoelectric Materials

- What are piezoelectric materials
- PZT properties and material constants
- Piezoelectric films
- Nonlinear effects
- Hysteresis, creep, depoling
- Incorporating PZT into structural systems
- Electrostrictive materials (PMN)
- Design with piezoelectrics

Shape Memory Alloys

- What are shape memory alloys?
- Constitutive Models
- Tanaka Model, Liang and Rogers Model, Brinson Model
- Testing of SMA Wires, SMA applications
- Design with Shape Memory

Project Overview

The project consists of a design and analysis of a system using smart materials. Each subsection will result in a mini-design project.

Text

Course Notes prepared by instructors

Grading

Homework	30%
Project	25%
Midterm	20%
Final	25%
Total	**100%**

PKU Globex Julmester®

Neural Prosthetic Engineering (3 Credits)

神经假体工程

Instructor	**Sung June KIM**, Dept of Electrical & Computer Engineering, Seoul National University, Korea, (kimsj@snu.ac.kr)	
Synopsis	The aim of this course is to understand the principles and state-of-the arts development of the Neural Prosthesis. Neural prosthesis is an electronic implant that interfaces with nervous systems. Through direct electrical stimulation of nerves, it can help restore damaged or lost sensory or motion functions. Typical examples include cochlear implant and retina implant recently developed for severely hearing and vision impaired patients respectively. More recently interfacing with neurons in brain draws more attention for both therapeutic and scientific purposes. In this lecture we will cover all engineering aspects of the auditory, visual prostheses, and deep brain stimulation.	
Offering	2017 Julmester (July Semester)	
Audience	All levels of Engineering Students (Some basic electrical circuits will be taught during the class.)	
Classroom	Room xxx, Teaching Bldg. No. XX, Peking University	
Schedule	Class: 8-11 AM, M-F, July 3–21, 2017	Total Contact Hours: 45
	Final Exam: 8-10 AM, July 22, 2017	
Objective	To understand fundamentals of neural prosthetic engineering and their application in auditory, visual prostheses and deep brain stimulation.	
Topics	**1. Overview** **2. Fundamentals** Neural Potentials Bioelectric Interface Bioinstrumentation **3. Neural Prostheses** Cochlear implant Retinal Implants	Deep brain stimulation Functional Electric Stimulation (FES) Brain Machine Interface (BMI) **4. New Developments** Optical Neural Recording Optical Neural Stimulation **5. Regulatory Approval** **6. Term project presentation**
References	1. PDF files (uploaded on the day before the class or earlier) 2. D. Zhou, David and E. Greenbaum, eds. *Implantable Neural Prostheses 1: Devices and Applications*, Springer, 2009. 3. P. Troyk and S. Cogan, "*Sensory Neural Prostheses*," in *Neural Engineering*, B. He, Ed., ed: Springer US, 2005, pp. 1-48. 4. Other journal papers	
Grading	Midterm Exam 20% Final Exam 20% Homework 20% Term Project 30% Attendance 10% **Total 100%**	

PKU Globex Julmester®

Compliant Robotics: Humanoids to Soft Robots (3 Credits)

柔性化机器人：从类人到软体

Instructor	**Hongbin LIU**, Centre for Robotics Research, Department of Informatics King's College London, UK (Hongbin.liu@kcl.ac.uk)
Synopsis	Traditional industrial robots have been designed to be as rigid as possible to ensure good motion precision; however, because of the massive rigidity, it can make them dangerous when operating in close proximity with humans. Further, as robots expand their domain into healthcare and home service, the issues of safety, adaptability and energy efficiency become a primary concern. To address these challenges, scientists are developing a new generation of compliant robots by adopting flexible and soft materials in their construction. This course aims to provide students with an essential knowledge for compliant robotic modeling, perception, interactive control and path planning. The topics covered include compliant robotic systems such as robot hands with compliant fingers and soft fingertips, flexible snake robot and soft octopus robot. This course involves a hands-on coding exercise to facilitate the implementation of algorithms for solving real-world problems.
Offering	2017 July Semester (Julmester)
Audience	Year 3 & 4 Undergraduate and Graduate Students
Classroom	Room xxx, Teaching Bldg. No. XX, Peking University
Schedule	Class: 8-11 AM, M-F, July 3–21, 2017 | Total Contact Hours: 45 | Final Exam: 8-10 AM, July 22, 2017
Objectives	• Introduction of the state of the art robotic technology from humanoids to soft and flexible robots • Understand and develop kinematic and mechanical models for robotic systems • Understand and implement different methods for estimating and control the robot position and the interaction force • Understand and implement AI methods for robot perception and path planning
Syllabus	Modeling of Different Robot Systems • Rigid-link robot models • Forward/Inverse Kinematics • Continuum/flexible robot model • Mechanics for continuum robots Robot Controls • Position control • Redundancy control • Force / Impedance control Robot Path Planning • Real-time Potential field • A* path planning Estimate/Perceive Robot Position/Speed/Force • Probabilistic approaches • Kalman filtering • Bayesian filtering
Project	3 project assignments that include a final team project presentation
Text	Course Notes – will be provided by the instructor
References	• Sebastian Thrun, Wolfram Burgard, Dieter Fox, *Probabilistic Robotics*, The MIT Press, 2005. • Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo, *Robotics: Modelling, Planning and Control,* Springer-Verlag London, 2009.
Grading	2 Individual Projects @ 15% each — 30% 1 Final Teamwork Project (Team Presentation) — 30% Final Exam — 40% **Total — 100%**

PKU Globex Julmester®

Inter-Cultural Design for a Responsible Business Model (4 Credits)

跨文化设计：负责任的商业模式

Instructor	**Marc LUCAS**, Mines Paris Tech, Paris France, (marc.lucas@mines-paristech.fr)
Synopsis	In this course, you will actively participate in the analysis and design of a responsible business model with a world leading multinational company. It involves teamwork between Western and Asian students, working in an inter-cultural environment on a real industrial case. This course offers you an opportunity to learn how to collect and interpret scientific data in a real engineering system, in contrast to the textbook models taught in class. You will be invited in a plant to propose a feasible solution. At the end of the course you will gain a real life experience in project management, in teamwork and intercultural management.
Offering	2017 Julmester (July Semester)
Audience	2nd & 3rd Year Undergraduate Students (open mainly to Engineering and Science, other majors welcome). **Students are selected based on a successful interview with the instructor.**
Classroom	Room XX, Teaching Bldg. No. XX, Peking University
Schedule	Class: 8 AM-3 PM: July 3-21, 2017 — Field Trip: July 4-8, 2017 — Total Contact Hours: 60 — Final Exam: None
Field Trip: Plant Visit	**July 4-8, 2017**: Full Time at an industrial site. Students taking this course will not be able to register for other Globex courses as the Field Trip requires an off-campus travel. As an example of an industrial partner: L'Oréal Cosmetics (2015: Yichang & 2016: Suzhou)
Objectives	• **Develop inter-cultural skills**: they will learn why it is so relevant for industries to recruit future managers with inter-cultural skills and with a global solving problem approach. • **Discover a company from inside through a real project**: a week will be dedicated to visit companies and to meet managers and decision makers in industries in order to understand the context, the limits and the aim of their mission. • **Work together as a multi-cultural team**: they will learn how to work with students of other culture in a professional and globalized context. • **Analyze and design a practical method of an industrial project management**: they will be able to develop a methodology and to organize their team and personal works in order to accomplish their mission. • **Gain a first professional experience**: the topic of the course directly relates to industrial modern issues, which are relevant topics for companies, public institutions and the citizens at a global scale.
Topics	1. **Examples of application fields** **2015: "The carbon neutral plant", a new global challenge for society and business**: what are the new opportunities for carbon free industries? Why it is relevant for a responsible business model? **2016: "Industry 4.0".** What does a digital factory mean? How may the company apply this new concept to its Suzhou plant? How will it impact the manufacturing and the role played by the teams? 2. **Project management basis in process industrie**s: what are the fundamentals of project management? What is the standard methodology and what are the main tools? 3. **Intercultural teamwork principles**: What are the main principles of a successful collaboration in an inter-cultural environment? 4. **Professional communication** (technical written report and team oral presentation): how to write a professional report addressed for engineers and managers and how to prepare a successful viva.
References	1. Bahadori A., Clark M. and Boyd B., 2013. Essentials of Water Systems Design in the Oil, Gas, and Chemical Processing Industries. Springer. 102p. 2. Labuschagne C., Brent A.C. and Claasen S.J., 2005. Environmental and Social Impact Considerations for Sustainable Project Life Cycle Management in the Process Industry. Corporate Social Responsibility and Environmental Management, Vol. 12, 38-54. 3. Munier N., 2013. Project Management for Environmental, Construction and Manufacturing Engineers: A Manual for Putting Theory into Practice. Springer. 250p. 4. Sotos M., 2015. GHG Protocol Scope 2 Guidance, An amendment to the GHG Protocol Corporate Standard. World Resources Institute. 116p. 5. Zhu S., He C. and Liu Y., 2014. Going green or going away: Environmental regulation, economic geography and firms' strategies in China's pollution-intensive industries. Geoforum, Vol. 55: 53–65.
Grading	Attendance and Participation 10% Project Assessment Individual & Small Group Contributions 40% Intercultural Team Work Assessment Final Design & Technical Report 20% Collective Oral Presentation 30% **Total 100%**

PKU Globex Julmester®

Chemical and Biological Sensors (3 Credits)

化学和生物传感器

Instructor	**Jin-Woo CHOI**, School of Electrical Engineering & Computer Science, Louisiana State University, USA (choijw@lsu.edu)
Synopsis	This course is designed to introduce fundamentals of chemical and biological sensors to undergraduate students in engineering and other relevant disciplines. Recognition and transduction are two critical functions of a sensor or a sensing system. Students will learn the basic sensing principles and elements followed by various application-oriented examples such as gas sensing, glucose monitoring, toxicity detection, disease detection, and DNA detection. Recent developments in miniaturized biosensors will also be covered.
Offering	2017 July Semester (Julmester)
Audience	Year 3 & 4 Undergraduate and Graduate Students
Classroom	Room xxx, Teaching Bldg. No. XX, Peking University
Schedule	Class: 8-11 AM, M-F, July 3–21, 2017 | Total Contact Hours: 45 | Final Exam: 8-10 AM, July 22, 2017
Objective	To understand fundamentals of chemical and biological sensors; molecular recognition and transduction principles; a variety of sensing techniques, and performance factors of chemical and biological sensors.
Topics	**1. Introduction and Overview of Transduction Mechanism** **2. Fundamentals of Chemical and Biological Sensors** Basics of biomolecules Recognition element and molecular immobilization Performance factors and sensor **3. Sensing/Transduction Mechanisms** Electrochemical detection Semiconductor-based sensors Optical detection Mechanical detection Other sensing mechanisms **4. Recent Developments** Emerging biosensors and nanobiotechnology Future outlook **5. Term project presentation**
References	• Class notes and handouts • B. R. Eggins, "Chemical Sensors and Biosensors," John Wiley & Sons, 2002 • F.-G. Banica, "Chemical Sensors and Biosensors," John Wiley & Sons, 2012 • Other journal papers
Grading	Midterm Exam 20% Final Exam 20% Homework 20% Term Project 30% Attendance 10% **Total 100%**

PKU Globex Julmester®

China: Past, Present and Future (3 Credits)

中國：過去、現在和未來

Instructor	**Iris MA**, University of Texas at Austin, USA (iris.ma@austin.utexas.edu)		
Synopsis	This course is a broad introduction to the culture, history, and society of China from ancient times to present. It not only traces the major intellectual, economic, literary and social developments, but also, shows how the idea of Chinese tradition and culture is continually invented and re-invented over the course of its history. It illustrates, as well, how the past has greatly shaped and continues to influence contemporary Chinese society. Through an examination of key concepts from art, language, literature, philosophy and religion, the course provides a foundation for students to understand contemporary China and interpret its future direction.		
Offering	2017 Julmester (July Semester)		
Audience	Undergraduate and Graduate Students (all majors and all levels) with no prerequisites		
Classroom	Room xxx, Teaching Bldg. No. XX, Peking University		
Schedule	Class: 8-11 AM, M-F, July 3–21, 2017	Total Contact Hours: 45	Final Exam: No Exam
Objective	• To acquire a basic cultural literacy in the Chinese traditions and become familiar with dynastic reign periods, important figures and texts, and significant historical events. • To gain a comparative perspective on how the place that we know as "China" today has changed and transformed in the contexts of both East Asian and global histories.		
Topic	1. Over view – "China" in Time and Space 2. Origins: From Neolithic Period to the Shang dynasty 3. Classics, Intellectual Traditions, and Philosophical Foundations 4. From Kingdom to Empire 5. Thought and Religion in the Period of Division 6. Artistic and Literary Culture in Middle Imperial China 7. China's Commercial Revolution and Debates between Tradition and Innovation 8. The Steppe and China's Others 9. Literati Culture and the Voice from the Inner Quarters 10. The Manchu Empire and Imperialism 11. Remaking China: War and Revolution 12. Mass Campaigns and Building a New China 13. White Cat, Black Cat: Economic Liberalization and Developmentalism 14. The Rise of China in the 21st Century 15. Creating the Future: Directions and Challenges		
Reference	1. Patricia Buckley Ebrey, *China: A The Cambridge Illustrated History of China*, 2nd ed. (Cambridge University, 2010). 2. Materials provided by instructor.		
Grading	Two Individually-Authored Papers (5-6 pages in length and worth 30% each): 60% Group Presentation: 30% Attendance and Class Participation: 10% **Total 100%**		

PKU Globex Julmester®

Financial Decisions in Engineering Project Management (3 Credits)

工程项目管理中的金融决策

Instructor	**Daricha SUTIVONG**, Dept of Industrial Engineering, Chulalongkorn University (daricha.s@gmail.com)
Synopsis	The course introduces widely-used financial techniques for project evaluation. Based on the time value of money concept, the course examines how to analyze and valuate various cash flow patterns and provides popular economic measures for project assessment and selection, including the net present value and the rate of return, along with the application criteria for single and multiple project decisions. The course also addresses decision under uncertainties using techniques such as breakeven analysis, sensitivity analysis, decision tree, etc. Students will have an opportunity to perform a financial analysis of their interested problem in a group project and create management report and presentation.
Offering	2017 July Semester (Julmester)
Audience	Undergraduate and Graduate Students (all majors and all levels) with no prerequisites
Classroom	Room XXX, Teaching Bldg. No. XX, Peking University
Schedule	Class: 8-11 AM, M-F, July 3–21, 2017 · Total Contact Hours: 45 · Final Exam: No Exam
Objective	To develop an understanding of financial techniques used for project evaluation, project selection and decision under risk and uncertainties. Students will apply their knowledge to a real-world problem in a team environment.
Topics	1. Time Value of Money, Interest Rate, Economic Equivalence, Simple and Compound Interests 2. Cash Flow Analysis and Valuation: Single Cash Flows, Cash Flow Series 3. Nominal and Effective Interest Rates: Discrete Time Period, Continuous Compounding 4. Present Value Analysis: Equal-life Alternatives, Different-life Alternatives, Capitalized Cost, Payback Period 5. Annual Value Analysis: Capital Recovery, Equivalent Annual Value 6. Rate of Return Analysis: Single Alternative 7. Rate of Return Analysis: Multiple Alternatives 8. Breakeven Analysis: Single and Multiple Alternatives 9. Decision under Uncertainties: Sensitivity Analysis, Three Estimates, Expected Value Decision, Decision Tree 10. Financial Analysis Modeling 11. Creating Report and Presentation for Management
Text	Lecture Notes provided by the instructor.
Reference	Blank, L. and A. Tarquin. *Engineering Economy*, 7th edition. McGraw-Hill, 2012.
Grading	Quiz 1 (Topic 1-3) 25% Quiz 2 (Topic 4-7) 35% Group Project Presentation and Report 30% Attendance and Participation 10% **Total 100%**

PKU Globex Julmester®

Storyboarding for Entrepreneurs: Lights, Camera, Action! (3 Credits)

创业家的故事板:灯光,摄影,开机!

Instructor	**Gregory POGUE**, (gpogue@ic2.utexas.edu); **Bruce KELLISON** (bkellison@ic2.utexas.edu)	The University of Texas at Austin, USA

Synopsis	Entrepreneurs turn the possible into practice; ideas into products; aspirations into reality. This is done certainly through business processes – but persuasion, argumentation, logic and communication (written and oral forms) are also critical. Entrepreneurs must identify key market problems and fit solutions that create innovative economic opportunities in the form of products, services or platforms. This "fit with financial implication" is a value proposition. Value propositions must be further tailored to a specific audience who may buy, sell, channel, champion or distribute the product or service. The process requires deep engagement between entrepreneurs and market stakeholders in order to co-create value propositions that produce financial return. Students will engage their innovative idea using the *Entrepreneurial Storyboard*, a persuasive, rhetorical tool for business partnership communication. The class will apply theory and develop persuasive arguments for value and business expansion.
Offering	2017 Julmester (July Semester)
Audience	Year 3 & 4 Undergraduate and Graduate Students
Classroom	Room xxx, Teaching Bldg. No. XX, Peking University

Schedule	July 3–7, 2017	Class: 8 AM-12 PM, M-F	Total Contact Hours: 45	Final Exam: No Exam
	July 10, 12, 14, 2017	e-Class: 9:00-10:30 AM, M, W, F		
	July 17–21, 2017	Class: 8 AM-12 PM, M-F		

Objectives

To learn a process to take design, market, economic and operational-based arguments and develop a value proposition for a market-fitted solution linked with a strong economic model, roadmap to launch and "ask" for critical partner(s). Students can apply these skills to develop value propositions for business or other partnership endeavors in their future.

Topics

1. **Overview and Introduction to the Entrepreneurial Process – Measuring Market Problems**: Introduction to the Entrepreneurial Storyboarding process and execution of initial market-based experiments. Homework presentation, theory to practice instruction, after class "Get out of the Building" business experiments.
2. **Team Selection and Measuring Market Problems**. Each student presents a 5 slide PowerPoint detailing Idea to market (template provided). Initial presentations, Engagement of incubator managers and university mentors in the region with program to facilitate interviews and investigations outside of class. Preparation of initial PowerPoint for presentation the following day. Idea and team selections, theory to practice, after class "Get out of the Building" business experiments.
3. **Fitting the Total Solution**. Homework presentation, theory to practice instruction, after class "Get out of the Building" business experiments.
4. **Modeling an Economic Ecosystem and Linking a Business Model.** Homework presentation, theory to practice instruction, after class "Get out of the Building" business experiments.
5. **Roadmapping a "Go to Market" Strategy and Developing an "Ask."** Homework presentation, theory to practice instruction, after class "Get out of the Building" business experiments.
6. **Theory to Practice Discussion:** Team Laboratory – in class with TA, group meetings.
7. **Theory to Practice Discussion:** Team Laboratory – in class with TA, group meetings; Turn in Interim Project – PowerPoint and 1,000 word essay.
8. **Theory to Practice Discussion:** Team Laboratory – in class with TA, group meetings.
9. **Storyboard Review and Feedback.** Engagement of incubator managers in the region to provide feedback on interim project. Homework presentation, theory to practice instruction, after class "Get out of the Building" business experiments.
10. **Company Economic Modeling: Development and presentation of financials:** Homework presentation, theory to practice instruction, after class "Get out of the Building" business experiments.
11. **Funding Strategies for Startups.** Incubator managers will help build a funding panel for Q&A with classes – Loans, Crowdfunding, Angel and VC investments; Homework presentation, theory to practice instruction, after class "Get out of the Building" business experiments.
12. **Presenting a Startup Value Proposition:** Homework presentation, theory to practice instruction, after class "Get out of the Building" business experiments.
13. **Final Project Due and Final Presentation:** Turn in final project – PowerPoint and 1,000 word essay; Final presentations to mentors and incubator managers.

References

1. Crossing the Chasm, 3rd Ed: Marketing and Selling Disruptive Products to Mainstream Customers (Collins Business Essentials) 2014.
2. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses (Crown Publishing) 2011.
3. Pogue G.P., et al., 2016. Iteration strategies for successful positioning of innovative products into new markets. IEEE Conference Publications. pp. 1-9. DOI:10.1109/IPCC.2016.7740539.
4. Mulcahy, D. 6 Myths About Venture Capitalists. May 2013 Harvard Business Review.

Grading

Class Participation and Homework	30%
Interim Project Assessment	30%
Final Project Assessment	40%
Total	**100%**

PKU Globex Julmester®

Finite Element Modelling for Structural Integrity & Biological Applications (3 Credits)

有限元建模在结构完整性和生物学上的应用

Instructor	**Mark HOFFMAN**, Dept of Materials Science & Engineering (mark.hoffman@unsw.edu.au) **Garth PEARCE**, Dept of Mechanical & Manufacturing Engineering (g.pearce@unsw.edu.au)	The University of New South Wales
Synopsis	Finite element modelling is a powerful computational method which is the cornerstone of modern design. Amongst other things, it enables accurate prediction of a mechanical behavior of structures enabling prediction of structural integrity through mechanical yield, thermal strain, fracture and fatigue. It is particularly useful in industries such as the aerospace, nuclear and biomedical devices which have high design constraints and where prototype testing is particularly challenging. A new area where finite element modelling is being applied is to understand the behavior of biological tissue such as teeth, bone and human organs, which have unique multiscale design, and the effect of factors such as disease, exercise and damage.	
Offering	2017 Julmester (July Semester)	
Audience	Year 3 & 4 Undergraduate and Graduate Students	
Classroom	Room xxx, Teaching Bldg. No. XX, Peking University	
Schedule	Class: 1-4 PM, M-F, July 3–21, 2017	Total Contact Hours: 45	Final Exam: 1-3 PM, July 22, 2017	
Objective	To understand the principles of finite element modelling and its application to real world problems, particularly those associated with structural integrity and biological applications and the associated complex design scenarios. By the end of the course students will have the skills to apply finite element modelling to a wide range of scenarios applicable in both research and professional design.	
Topics	1. ***Review of Finite Element Method (FEM) fundamentals***: The principles behind finite element modelling, the underlining mathematical principles and examples of application to real life situations. 2. ***Creation of FEM elements, linear analysis in solid and structural mechanics***: application of the displacement-based finite element method for the creation of stiffness matrices for bars and plates, solution methods for finite element problems. 3. ***Applications of finite element modelling for structural integrity***: Prediction of stress and strain from displacement method, fracture and off-nodal loading. Integration of structural and thermal analyses. 4. ***FEM applications for composite materials***: non-isotropic materials behavior, models for determining degradation and failure. 5. ***Biological materials and multiscale FEM***: the multiscale structure of biological materials and the design of multiscale finite element models. Application of multiscale FEM for predicting the influence degradation of tissue under mechanical loading. Real-life examples. 6. ***Future applications***: Opportunities for the application of FEM in other scenarios such as civil structures and biomedical devices.	
References	1. Cook, R. D., Malkus, D. S., Plesha, M. E., Witt, R. J. (2002). Concepts and Applications of Finite Element Analysis, 4 th Ed, John Wiley & Sons. 2. Chandrupatla, T. R., Belegundu, A. D. (2011) Introduction to Finite Elements in Engineering, 4th Ed, Prentice Hall (Pearson) 3. J. Fish, T. Belytschko, (2007) A First Course in Finite Elements (2007) Wiley & Sons	
Grading	Homework Assignments 20% Project Assignment 30% • *Interim Project Assessment* (10%) • *Final Project Assessment* (20%) Midterm Exam 10% Final Exam 40% Total 100%	

PKU Globex Julmester®

Design, Materials and Manufacturing: An Integrated Tripartite Approach (3 Credits)

设计、材料和制造：集成化的三分模式

Instructor	**Mike MUNRO**, Dept of Mechanical Engineering, University of Ottawa, mmunro@UOttawa.ca	
Description	Primarily, a course on advanced fiber-reinforced polymer and traditional metal manufacturing processes with constant connections with associated engineering materials issues and mechanical design predictions. Emphasis will be on the ability to predict the manufacturability of metal and fiber-reinforced components.	
Offering	2017 Julmester (July Semester)	
Audience	Year 3 and Year 4 Undergraduate Students	
Prerequisites	Introductory courses in mechanical properties of metals and polymers	
Classroom	Room xxx, Teaching Bldg. No. XX, Peking University	
Frequency	Class: 1-4 PM, M-F, July 3–21, 2017	Total Contact Hours: 45
	Final Exam: 1-3 PM, July 22, 2017 (closed book, equation sheet provided)	
Objectives	**1.** Become familiar with advanced fiber-reinforced polymer and traditional metal manufacturing processes. **2.** Understand the relationships between mechanical design, engineering materials and manufacturing processes **3.** Using design formulae and guidelines, determine the manufacturability of components.	
Topics	1. Connections between materials engineering, mechanical design and manufacturing processes (examples) 2. Introduction to fiber-reinforced polymer composite materials 3. Filament winding (manufacturing-controlled design) 4. 2D braiding (manufacturing-controlled design) 5. Introduction to traditional metal manufacturing processes 6. Manufacturing and materials-controlled design equations for traditional metal manufacturing processes (machining; sand, die and investment casting; rolling, forging, extrusion; deep drawing and sheet forming, and powder metallurgy processes).	
References	• Course notes will be provided in soft copy form. They will be sufficient for course material. • Reference text (if desired): S. Kalpakjian (main author), *Manufacturing Engineering and Technology*, any edition will do.	
Grading	Final Exam 50% MidTerm Exam 20% Assignments 30% **Total 100%**	

PKU Globex Julmester®

Modeling of Dispersed Multicomponent, Multiphase Flows in Resource Industries (3 Credits)

原料工业中的分散多组分和多相流动建模研究

Instructor	**Sean SANDERS**, Dept. of Chemical & Materials Engineering, University of Alberta, Canada (ssanders@ualberta.ca)
Synopsis	Dispersed multicomponent and/or multiphase flows are commonly encountered in nearly every extractive resource industry, including oil & gas production and the mining / mineral processing industries. In many cases, the presence of the dispersed phase produces complex non-Newtonian behavior. Many conventional approaches to process design are then no longer applicable and in fact the assumption of Newtonian behavior under such conditions can have disastrous consequences. Different types of non-Newtonian behavior, and the underlying causes, will be described. Rheometry (the science of characterizing the flow of non-Newtonian fluids) and numerous case studies involving actual engineering examples will be reviewed.
Offering	2017 Julmester (July Semester)
Audience	Year 3 & 4 Undergraduate and Graduate Students
Classroom	Room XX, Teaching Bldg. No. XX, Peking University
Schedule	Class: 1-4 PM, M-F, July 3–21, 2017 | Total Contact Hours: 45 | Final Exam: 1-4 PM, July 22, 2017
Objective	To better understand the behavior of non-Newtonian systems by learning about, and connecting, new concepts, engineering tools, and applications. By the end of this course, the student will have the skills required to scale-up, design and/or assess the performance of some basic process unit operations involving non-Newtonian, multiphase/multicomponent flows.
Topics	1. **Background and review**: Basic concepts, multiphase flow terms and classifications, review of Newtonian fluids. 2. **Classification of homogeneous fluid behaviour**: Rheograms, non-Newtonian fluid models. 3. **Rheometry**: Introduction of the types of techniques used, and their applicability: capillary, concentric cylinder, cone-and-plate rheometers; steady-state and oscillatory measurements. 4. **Applications and case studies**: Pipeline transport of tailings, pipeline transport of emulsions, static mixers, mixing tank design, flow through porous media. 5. **Underlying causes of non-Newtonian behaviour**: Particle / droplet size, colloid and surface forces, process conditions (chemistry, pH, wettability) and their effect on rheology.
References	1. R.P. Chhabra and J.F. Richardson, *Non-Newtonian Flow and Applied Rheology, 2nd Ed.*; Butterworth-Heinemann (2008). 2. M. Rhodes, *Introduction to Particle Technology, 2nd Ed.*; John Wiley & Sons (2008). 3. H.A. Barnes, J.F. Hutton and K. Walters, *Introduction to Rheology*; Elsevier (1989). 4. R.P. Chhabra, *Bubbles, Drops and Particles in Non-Newtonian Fluids, 2nd Ed.*; CRC Press (2006). 5. L.L. Schramm, *Emulsions, Foams Suspensions and Aerosols*, 2nd Ed.; Wiley (2014).
Grading	Homework Assignments 20% Project Assignment 30% • *In-class presentation* (10%) • *Project report* (20%) Midterm Exam 20% Final Exam 30% **Total 100%**

PKU Globex Julmester®

The Materials Genome Assessment (3 Credits)

材料基因组评估

Instructor	**Cedric WEBER**, Physics, King's College London, UK (cedric.weber@kcl.ac.uk)
Synopsis	This course provides a pedagogical introduction to computational modeling. Computational modelling is used in a wide range of applications, such as material science, bio-medical engineering, finance, etc. In particular, scientific modeling can be used to accelerate the discovery of new materials (The so-called "materials genome" project): nowadays, simple physical equations are implemented in computer software, enabling researchers to carry out "virtual" experiments with predictive capabilities. The course will provide the students with an awareness of the importance of material discovery and its societal impact, and during hands-on sessions we will provide the students with a tutorial for *Materials Studio*, a modern computational tool suite. The course will consist of both lectures and practical sessions in the computer room. We will also have discussion sessions and group work, where material discovery is discussed in the wider context.
Offering	2017 Julmester (July Semester)
Audience	Undergraduate and Graduate Students (all majors and all levels) with no prerequisites
Classroom	Room XX, Teaching Bldg. No. XX, Peking University
Schedule	Class: 1-4 PM, M-F, July 3–21, 2017 Total Contact Hours: 45 Final Exam: No Exam
Objective	To develop an understanding of the fundamental components of computational modelling and its application to materials and molecules. During the first part of the course, we aim at providing the students with an awareness of the importance of materials discovery, its societal impacts, and provide an introduction to some exotic state of matter such as super-conductors or low-dimensional materials, such as graphene. We will also provide an introduction to "materials genomics". During the second part of the course, the aim is to provide a pedagogical introduction to some very simple but important computational algorithms, such as Monte Carlo and how to solve differential equations (with little or no knowledge of the mathematics). We will then discuss some of the most advanced quantum modelling techniques (so-called density functional theory) and classical modelling approaches (so-called molecular dynamics), which can be applied to materials discovery. The course will focus on both the theory and its applications, and a tutorial to the computational suite *Materials Studio* will be given during hands-on session.
Topics	1. Materials discovery to meet the challenges of the 21st century 2. What is computational modeling, and how can it be used to investigate the "materials genome" 3. Monte Carlo 4. Hands-on: computing the value of Pi by using game theory 5. How to solve differential equations with little knowledge of the mathematics 6. Hands-on: explaining the breakdown of the Tacoma bridge 7. Strategies to guide materials design with software engineering 8. Introduction to *Density functional theory* and its application to material discovery 9. A tool suite to model materials: *Materials Studio* 10. How to predict the structure of a material 11. Time evolution with molecular dynamics 12. Hands-on: Carbon nanotubes 13. Quantum computing and quantum information 14. How to predict colors: optical absorption and quantum mechanics 15. Superconductors and their applications 16. A single atomic sheet of atoms: Graphene
References	1. D.P. Landau, A guide to Monte Carlo simulations in statistical physics, Cambridge Univ. Press, 3rd edition (2009) 2. D. Sholl & J.A. Steckel, Density functional theory: a practical introduction, John Wiley § Sons. Inc. London (2011) 3. D. Frenkel & B. Smit, Understanding Molecular Simulations, Academic Press (2001) 4. Other articles provided by instructor.
Grading	Small Group Project Presentation 1 — 30% Small Group Project Presentation 2 — 30% Mid-Term Exam — 30% Attendance and Participation — 10% **Total 100%**

PKU Globex Julmester®

Combustion Science and Engineering (3 Credits)

燃烧科学与工程

Instructor	**Peng ZHANG**, Department of Mechanical Engineering, The Hong Kong Polytechnic University, Hong Kong (pzhang@polyu.edu.hk)
Synopsis	The course aims to introduce combustion science and engineering to undergraduate students with background in engineering or science. Various aspects of combustion science will be discussed and many practical issues in combustion engineering will be covered. In the course, the students will obtain basic knowledge on combustion and its applications, such as practical fuels, thermochemistry and chemical kinetics of fuel combustion, characteristics and stability of non-premixed and premixed flames (combustion), ignition and flame extinction, various combustion energy conversion devices, and environmental effects of combustion. By taking this course, the students are expected to develop a sound understanding of relationships among fuels, combustion processes, combustion devices and pollutant emissions.
Offering	2017 July Semester (Julmester)
Audience	Year 3 & 4 Undergraduate and Graduate Students
Classroom	Room xxx, Teaching Bldg. No. XX, Peking University
Schedule	Class: 8-11 AM, M-F July 3–21, 2017 / Total Contact Hours: 45 / Final Exam: 8-10 AM, July 22, 2017 (closed-book)
Objective	To develop an understanding of relationships among fuels, combustion processes, combustion devices and pollutant emissions through studying basic combustion science and its applications to a variety of combustion energy conversion devices.
Topics	1. **Introduction; Review of thermodynamics, conservation laws, heat and mass transfer.** 2. **Chemical thermodynamics (theory)**: Phase equilibrium; Chemical equilibrium in gas mixtures. 3. **Chemical thermodynamics (applications)**: CEA (NASA free software) and its applications. 4. **Chemical kinetics**: Law of mass action; Arrhenius law; Chain reaction mechanisms. 5. **Oxidation of fuels**: Practical fuels; Oxidation mechanisms of fuels; NO_X and soot formation. 6. **CHEMKIN II and its applications**: SENKIN, PREMIX and others. 7. **Laminar non-premixed flames**: Chambered flame; Vaporization and combustion of droplet. 8. **Laminar premixed flames**: Detonation and deflagration; Laminar flame speed. 9. **Limit phenomena**: Ignition; Flame extinction; Flame stabilization. 10. **Gas-fired furnaces and boilers; Premixed-charge engine combustion.** 11. **Oil-fired furnace combustion; Diesel engine combustion; Gas-turbine spray combustion.** 12. **Coal-fired furnace combustion; Chimney and flue.**
References	1. I. Glassman, *Combustion,* 3rd Edition. 2. K. W. Ragland & K. M. Bryden, *Combustion Engineering*, 2nd Edition. 3. Supplementary course materials will be distributed when necessary.
Grading	Homework Assignment (individual-based) 30% • Three HWs @ 10% each CHEMKIN II Project (individual or group-based) 30% • Class Presentation: 10% • Project Report: 20% Final Exam (individual-based) 30% Attendance & Discussion 10% **Total 100%**

PKU Globex Julmester®

Masterpieces of Traditional and Contemporary Chinese Art (2 & 3 Credits)

中国传统与当代艺术中的杰作

Instructor	**Yunchiahn C. SENA**, Department of Art and Art History, Wesleyan University (ysena@wesleyan.edu)
Synopsis	Taking advantage of the rich resources of Chinese art in the fantastic museums in Beijing and other cities in China, this course introduces Chinese art from ancient to contemporary times by directly examining masterpieces in these museums. Through a thorough study of the artworks, students develop an in-depth understanding about Chinese culture and society today. The topics of this course include ancient rituals, elite culture, Buddhist icons, avant-garde, popular art, and built environment. We will meet in classroom for lectures and discussions on Mondays, Tuesdays, and Fridays. On Thursdays, we will meet in museums and art galleries around Beijing to examine artworks and meet with curators. An optional trip to Suzhou, Shanghai and Hangzhou to visit museums and historical sites will take place from Jul 23-27.
Offering	2017 Julmester (July Semester)
Audience	Undergraduate and Graduate Students (all majors and all levels) with no prerequisites
Classroom	Room XX., Building XX, Peking University
Schedule	<u>Class Options</u>: 2 credits: Jul 3-21, M,Tu,F, 1:00-3:30 PM (lecture), Th 2:00-4:30 PM (Field Trip 1) & W-no class 3 credits: Jul 3-21, M,Tu,F, 1:00-3:30 PM (lecture), Th 2:00-4:30 PM (Field Trip 1) & W-no class Jul 23-27, Field Trip 2 (Suzhou, Hangzhou, Shanghai), travel charges apply <u>Total Contact Hours</u>: 2 credits: 30; 3 credits: 45 <u>Final Exam</u>: None but one final 6-page paper required on Jul 21st
Objective	To develop an appreciation for Chinese art and an understanding of Chinese culture and society today
Topics	<u>Section 1: Jul 3-7</u> M,Tu,F 1:00-3:30 PM: Traditional Chinese art from the prehistorical to middle periods Th 2:00-4:30 PM: Visit the National Museum of China (中国国家博物馆) (Report due Jul 7) <u>Section 2: Jul 10-14</u> M,Tu,F 1:00-3:30 PM: Chinese art from the late imperial to modern periods (20th century) Th 2:00-4:30 PM: Visit the National Art Museum of China (中国美术馆) (Report due Jul 14) <u>Section 3: Jul 17-21</u> M,Tu,F 1:00-3:30 PM: Development and current state of contemporary Chinese art since 1980s Th 2:00-4:30 PM: Visit the Caochangdi Art District (草場地艺术区) (Report due Jul 21) Group Project Presentations on Jul 17, Final Paper on a self-selected topic due Jul 21 <u>Section 4:* Jul 23-27 (optional but required for 3 credits)</u> Visit museums and historical sites in Suzhou (the Suzhou Museum, the Lingering Garden), Wuzhen, Hangzhou (the Southern Song Dynasty Guan Kiln Museum, West Lake and the Xixi National Wetland Park) and Shanghai (the Shanghai Museum, the China Art Museum). *The field trip is optional and charges apply to cover incurred travel expenses. Those who elect to participate will earn 3 credits and those who do not get only 2 credits.
Text	• Robert Thorp and Richard Vinograd, *Chinese Art and Culture* (New York: Harry N. Abrams, 2001) • Wu Hung, *Contemporary Chinese Art* (New York: Thames & Hudson, 2014)
Grading	3 individually-written reports on museum visits (3 pages each) × 15% — 45% 1 group presentation on a given topic (15 min with texts & graphics) — 25% 1 individually-written final paper on a self-selected topic (6 pages) — 30% Total — 100%

PKU Globex Julmester®

China Economy: Growth and Global Connections (3 Credits)

中国经济：增长与全球联系

Instructor	**Susan MAYS,** Center for East Asian Studies, University of Texas at Austin, USA (smays@utexas.edu)
Synopsis	This course addresses economic development in China, in global context. The course examines trends in trade, foreign investment, ownership (i.e., public vs. private), finance, the workforce, and consumption, as well as key business sectors. The class also considers challenges and opportunities in China in the areas of environment, energy, education, and healthcare. Taught by an economic historian, the course considers China's unique history, culture, and business context, as well as global partnerships and influences. The reading and course materials are by scholars, leaders in business, economics and policy, as well as journalists.
Offering	2017 Julmester (July Semester)
Audience	Undergraduate and Graduate Students (all majors, all levels) with no prerequisites
Classroom	Room xxx, Teaching Bldg. No. XX, Peking University
Schedule	Class: 1-4 PM, M-F, July 3–21, 2017 / Total Contact Hours: 45 / Final Exam: No Exam
Objective	To understand the fundamentals of China's economy and to examine business trends, opportunities, and challenges.
Topics	1. China's Reform and Opening from 1978 and Chinese Governance 2. Rural-to-Urban Labor Migration, Export-led Development, and Foreign Trade 3. Business Ownership (private, state-owned, Sino-foreign joint ventures, foreign owned) 4. Financial Services and the Legal System 5. High Tech Sectors and Entrepreneurship 6. The Education System and China's Talent Pool 7. Energy and Environmental Challenges 8. Family Economics and the Healthcare Industry 9. The Foreign Sector in China and Chinese Investments Abroad 10. Infrastructure Initiatives
References	Reading materials provided by the instructor
Grading	3 Weekly Quizzes (multiple choice and one essay) 60% Group Report 20% Group Presentation 20% **Total 100%**

PKU Globex Julmester®

The Big History of Our Planet: A Scientific Journey Over 14 Billion Years of History (3 Credits)

地球大历史：穿梭一百四十亿年的科学之旅

Instructors	Chi-wang CHAN (cwchan1@hku.hk) William M.Y. CHEUNG (willmyc@hku.hk)	Faculty of Science, The University of Hong Kong
Synopsis	History should not be confined to describe human activities only. To understand the origin of many of the features around us, it is actually necessary for us to trace all the way back to the beginning of our universe so as to find a more satisfying answer. In this course we will survey the "Big History" and go through the milestones of the past of our world: the beginning of our universe, the formation of our Earth, the evolution of humans, the development into modern society via practising agriculture and industrialization, etc. This course will naturally touch upon different academic disciplines, and investigate what are the favourite conditions that urged our world to keep on increasing its complexity. In the end this allows us to reflect upon how humans fit in our world. This course is equivalent to SCNC1113 offered at the University of Hong Kong.	
Offering	2017 July Semester (Julmester)	
Audience	Undergraduate and Graduate Students (all majors and all levels) with no prerequisites	
Classroom	Room xxx, Teaching Bldg. No. XX, Peking University	
Schedule	Class: 1-4 PM, Mon-Fri, July 3–21, 2017 Except: 1-5 PM on July 11, 20, 21, 2017	
	Fieldtrip (optional): July 12 or 13, 2017	Total Contact Hours: 45 / Final Exam: 1-3 PM, July 22, 2017
Objective	By exploring the Big History of our planet: from the Big Bang of the Universe, the synthesis of different chemical substances, through the evolution of various species on Earth, to the establishment of modern human society, the course aims to: (1) discuss the process of scientific discovery, and how our current body of knowledge about Nature was established; (2) develop students' understanding of the multi-disciplinary nature of science; (3) develop students' understanding of the importance of science and technology to our society, in formulating policies in the society, and solving the future problems of our planet; (4) increase scientific literacy.	
Topics	Part I: From the Cosmos to the Atom 1. What is Big History? 2. Big Bang & the Evolution of Early Universe 3. Nucleosynthesis & the Formation of Elements 4. The Origin of Solar System & the Formation of the Earth Part II: From the Atom to Life 5. The Origin of Life on Earth 6. The Evolution of Life on Earth	Part III: From Life to Mind to Society 7. The Start of Agriculture 8. The Early Agrarian Society & Civilization 9. The Modern & Industrial Revolutions Part IV: Looking into the Future 10. The Anthropocene 11. The History of our Future
Field Trip	Visit Zhoukoudian (周口店) to view the *Peking Man* (*Homo erectus pekinensis*). For further details check out https://en.wikipedia.org/wiki/Peking_Man. Trip is optional and those electing to go will have to pay a charge.	
References	1. David Christian, Cynthia Brown and Craig Benjamin, *Big History: Between Nothing and Everything*; McGraw-Hill Education (2013). 2. Fred Spier, *Big history and the future of humanity*; 2nd Edition; Wiley-Blackwell (2015). 3. Charles Darwin, *The Origin of Species*, 1st Edition. 4. The Big History Project website: https://www.bighistoryproject.com/	
Grading	Individual Assignments	40%
	Group Project & Presentation	30%
	Final Exam	20%
	Participation	10%
	Total	100%