课程名（Coursename）  
Materials, Electronics and Renewable Energy  
  
课程代码（Coursenumber）  
I3  
  
课程对象（Audience）  
Graduates  
  
开课教师（Teacher）  
Prof. D. J. C. MacKay and Dr N. C. Greenham  
  
学期（Semester）  
  
课程描述（Description）  
This interdisciplinary course looks at the physical issues concerning energy generation, storage and use. The style will be varied–making use of simple physical estimates for a wide range of energy problems, but also looking in more detail at materials-based approaches to renewable energy. Only IA-level physics is a prerequisite; those who have experience of solid-state physics will find some parts of the course more straightforward, but the material will be taught and examined in such a way that prior knowledge in this area is not required.  
12 Lecture synopses: Lent Term – Chemistry courses  
Energy requirements and energy availability: Back-of-envelope models of energy consumption and production. Current and projected usage, fossil fuel reserves. Alternatives to fossil fuels: nuclear, wind, wave, tide, geothermal, solar.  
Moving, storing and transforming energy: Heat engines, heat pumps. Energy storage systems.  
Using and conserving energy: Transport of people and freight. Heating and insulation.  
Solar energy: Sunlight, the greenhouse effect, biofuels. Theoretical limits to conversion of solar energy.  
The hydrogen economy: Generation and storage of hydrogen. Fuel cells. Batteries.  
Electronic structure of molecules and solids: Tight binding band structure. Interaction with light. Excitons. Electrons and holes. Doping.  
Inorganic semiconductor solar cells: The p–n junction. Photovoltaic operation. Cell design, materials and performance. Beyond the Schockley–Quiesser limit; nanostructured materials.  
Molecular semiconductors: Materials and optical properties. Excitons. Photovoltaic devices: multilayers, bulk heterojunctions and dye-sensitised cells.  
Biological systems: Structure and optoelectronic operation: photosynthesis, purple bacteria, vision.  
  
课时信息（Totalhours）  
  
教参信息（Textbookinfo）  
1 Alternative Energy Resources : The Quest for Sustainable Energy by Paul Kruger (Hardcover - Mar. 10, 2006)  
ISBN-13: 978-0471772088  
世界各地拥有馆藏的图书馆（OCLC）:444  
2 Wind Energy Handbook by Tony Burton, David Sharpe, Nick Jenkins, and Ervin Bossanyi (Hardcover - Nov. 15, 2001)  
ISBN-13: 978-0471489979  
世界各地拥有馆藏的图书馆（OCLC）:345  
3 Crystal Growth of Silicon for Solar Cells (Advances in Materials Research) by Kazuo Nakajima and Noritaka Usami (Hardcover - Sept. 30, 2009)  
ISBN-13: 978-3642020438  
世界各地拥有馆藏的图书馆（OCLC）:19  
4 TiO2 Nanotube Arrays: Synthesis, Properties, and Applications by Craig A. Grimes and Gopal K. Mor (Hardcover - Aug. 21, 2009)  
ISBN-13: 978-1441900678  
世界各地拥有馆藏的图书馆（OCLC）:19  
5 Fuel Cell Engines by Matthew Mench (Hardcover - Mar. 7, 2008)  
ISBN-13: 978-0471689584  
世界各地拥有馆藏的图书馆（OCLC）:203  
6 Organic Nanostructured Thin Film Devices and Coatings for Clean Energy by Sam Zhang (Hardcover - June 25, 2010)  
ISBN-13: 978-1420093933  
世界各地拥有馆藏的图书馆（OCLC）:24  
7 Insulators for Icing and Polluted Environments (IEEE Press Series on Power Engineering) by Masoud Farzaneh and William A. Chisholm (Hardcover - Oct. 26, 2009)  
ISBN-13: 978-0470282342  
世界各地拥有馆藏的图书馆（OCLC）:38  
8 Handbook of Fuel Cells: Advances in Electrocatalysis, Materials, Diagnostics and Durability (v. 5 & 6) by Wolf Vielstich, Hubert A. Gasteiger, and Harumi Yokokawa (Hardcover - May 11, 2009)  
ISBN-13: 978-0470723111  
世界各地拥有馆藏的图书馆（OCLC）:16  
9 PEM Fuel Cell Electrocatalysts and Catalyst Layers: Fundamentals and Applications by Jiujun Zhang (Hardcover - Oct. 24, 2008)  
ISBN-13: 978-1848009356  
世界各地拥有馆藏的图书馆（OCLC）:162  
10 Transparent Conductive Zinc Oxide: Basics and Applications in Thin Film Solar Cells (Springer Series in Materials Science) by Klaus Ellmer, Andreas Klein, and Bernd Rech (Hardcover - Jan. 29, 2008)  
ISBN-13: 978-3540736110  
世界各地拥有馆藏的图书馆（OCLC）:92