

### Instructor Information

Name	Dr. Zayed Al_Hamamre	
Room NO.	Che-313	
Phone Number	5355000 Ext. 22895	
E-mail		
Office Hours	Will be specified latter	

### Course Information

Course Name	Special Topics: Fuel Cell Fundamentals and Technology	
Course Number		
Perquisites		
Credit Hours	3	
Semester	Summer Semester 2010\2011	
Class Meeting	Class	08:00-09:10 Room:

### Course Description

Course Objectives	This course is designed to familiarize students with the different modes of heat transfer and mathematical models which describe these modes.
Text Book	<ol style="list-style-type: none"> <li>1. O'Hayre, R., Cha, S.W., Colella, W., and Prinz, F.B., Fuel Cell Fundamentals, John Wiley and Sons, Ltd., New York, NY, ISBN-13 978-0-471-74148-0, 2006. ("FC Fund.")</li> <li>2. "Fuel Cell Handbook," 7th Edition, EG&amp;G Services, for U.S. Department of Energy contract number DE-AM26-99FT40575, National Energy Technology Laboratory, November, 2006. ("FC Handbook")</li> </ol>
References	<ol style="list-style-type: none"> <li>1. Larminie, J, and Dicks, A., Fuel Cell Systems Explained, John Wiley and Sons, Ltd., ISBN: 0-471-49026-1, 2000. ("FC Systems")</li> <li>2. Suddhasatwa Basu, Recent Trends in Fuel Cell Science and Technology, Springer, NewYork, USA, 2007.</li> <li>3. Supramaniam Srinivasan, Fuel Cells From Fundamentals to Applications, Springer Science+Business Media, LLC, 2006.</li> </ol>

### Course Assessment

Quizzes and short exams	20%	
Midterm (Closed book)	30%	
Final Exam	50%	

Course Contents			
Topic	Text 1	Text 2	Ref. 3
1. Course Introduction (½ hour) a. Prerequisites, Course Requirements Grading, Syllabus			
2. Fuel Cell Introduction (1 hour) a. Basic Operating Features b. Fuel Cell Stack c. Fuel Cell Systems Introduction d. Energy/Environmental Context e. Fuel Cell Types	Chapter 1	Chapter 1	Chapter 4: Section 4.3
3. Fuel Cell Thermodynamics (4½ hours) a. Free Energy b. Reversible Potential c. Fuel Cell Efficiency	Chapter 2	Chapter 2	Chapter 4: Section 4.4
4. Fuel Cell Types (3 hours) a. Introduction to all types b. Proton exchange membrane c. Solid oxide	Chapter 8	Chapters 3-7	Chapter 4: Section 4.3
5. Electrochemistry & Reaction Kinetics (3 hours) a. Basic electrochemistry b. Electrode kinetics	Chapter 3		Chapter 1 Chapter 4: Section 4.5 Chapter 5
6. Electrolytes & Charge Transport (3 hours) a. Types of Electrolytes b. Charge Transport Phenomena	Chapter 4		Chapter 2
7. Electrodes & Mass Transport (3 hours) a. Gas diffusion electrodes b. Mass transport mechanisms c. Physical & electrochemical limitations	Chapter 5		Chapter 2
8. Electrode & Electrolyte Materials (1½ hours) a. Materials Processing b. Design of Materials and Interfaces c. Optimal Design & Durability			Chapter 3
9. Fuel Cell			Chapter 4:

Characterization/Analyses (1½ hours)	Chapter 7		Section 4.6 Chapter 6
10. Fuel Cell Systems & Integration (4½ hours) a. Fuel processing b. Power conversion c. Other System Components d. Integrated Systems and Design	Chapter 9-10	Chapter 8	Chapter 8, Chapter 9
11. Cell Degradation (1½ hours) a. Corrosion, Erosion, Catalyst poisoning b. Thermal stresses, Oxidation			Section 1.3.5 Section 3.6

### Expected Course Outcomes

1. Know the wide scope of Fuel Cell Technology
2. Know how and where to use Fuel Cells
3. Know how to calculate the voltage generated from a Fuel Cell
4. Calculate the efficiency of a Fuel Cell
5. Understand the performance curve of the Fuel Cell
6. Realize the effect of temperature on Fuel Cell performance
7. Know different types of Fuel Cells and their characteristics
8. Calculate the amount of current withdrawn from all types of Fuel Cells

### Regulations

#### **I. Attendance:**

Attendance of classes is obligatory. Absence must be verified according to the university's regulation. It will also be factored into your grade.

#### **II. Quizzes and homework**

All students are required to finish their homework assignments, and submit them on time. Late homework will not be accepted under any circumstances. Popup quizzes will be given without any prior notice. You need to come prepared to class. In addition to the final exam, there will be one midterm exam. These exams will be challenging and comprehensive y time during the class

#### **IV. Conduct in classroom:**

While in the class room, all cell phones, PDAs, Laptops need to be turned off.