

<b>COURSE DESCRIPTION FORM</b>													
<b>Course Code and Title</b>	KM344 Fuel Cells												
<b>Course Semester</b>	6												
<b>Catalog Description (Content) of the Course</b>	Fundamentals of fuel cells, types of fuel cells, fuel processing technologies for fuel cell systems, commercialization and industrial application of fuel cells.												
<b>Main Textbook</b>	Fuel cell handbook 7th edition, EG&G Technical Services, Inc., U.S. Department of Energy Office of Fossil Energy National Energy Technology Laboratory												
<b>Supporting Textbooks</b>	Supramaniam Srinivasan, "Fuel Cells; From Fundamentals to Applications", Springer Publishing Company, USA 2006. • Noyes, R., "Fuel Cells for Public Utility and Industrial Power", Energy Techn. Rev. No.18, Noyes Data Corp., New Jersey (1977). • Blomen, J., Leo, J.M., Mugerwa, M.N., "Fuel Cell System", Plenum Press, New York (1993).												
<b>Course Credit (ECTS)</b>	3												
<b>Prerequisites of the Course (Compulsory attendance should be indicated here.)</b>	There is no prerequisite or co-requisite for this course												
<b>Type of the Course</b>	Elective												
<b>Instruction Language of the Course</b>	English												
<b>Object and Target of the Course</b>	To acquire knowledge on fuel cells and the fuel cell technology and make research on current fuel cell technology												
<b>Learning Outcomes of the Course</b>	<p>-To gain knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.</p> <p>-To identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.</p> <p>-To devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.</p> <p>-To work efficiently in intra-disciplinary teams.</p> <p>-To communicate effectively in Turkish, both orally and in writing; knowledge of a minimum of one foreign language.</p>												
<b>Mode of Delivery</b>	The mode of delivery of this course is Face to face												
<b>Weekly Schedule of the Course</b>	<table border="1"> <tbody> <tr> <td>1. Week</td> <td>Introduction, environment and energy, basic concepts.</td> </tr> <tr> <td>2. Week</td> <td>Definition of fuel cells</td> </tr> <tr> <td>3. Week</td> <td>Fuel cell components.</td> </tr> <tr> <td>4. Week</td> <td>Basic properties of fuel cells and Types of fuel cells.</td> </tr> <tr> <td>5. Week</td> <td>Basic properties of fuel cells and Types of fuel cells (continue).</td> </tr> <tr> <td>6. Week</td> <td>Fuels used in fuel cells, fuel preparation processes</td> </tr> </tbody> </table>	1. Week	Introduction, environment and energy, basic concepts.	2. Week	Definition of fuel cells	3. Week	Fuel cell components.	4. Week	Basic properties of fuel cells and Types of fuel cells.	5. Week	Basic properties of fuel cells and Types of fuel cells (continue).	6. Week	Fuels used in fuel cells, fuel preparation processes
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	9. Week	Alkalyne fuel cells (development, principles, application areas)																														
	10. Week	Phosphoric acid fuel cells (development, principles, application areas)																														
	11. Week	Solid polymer electrolyte fuel cells (development, principles, application areas)																														
	12. Week	Molten carbonate fuel cells (development, principles, application areas)																														
	13. Week	Solid oxide fuel cells (development, principles, application areas)																														
	14. Week	Problems in front of the commercialization of Fuel Cells, eneral use and industrial applications of fuel cells ( high and low temperature cycles)																														
<b>Educative Activities</b> <i>(Credit will be determined based on the time given for these activities. Should be filled carefully.)</i>	Theoretical Study Hours of Course Per Week Reading Searching in Internet and Library Preparing Reports Mid-Term and Studying for Mid-Term Final and Studying for Final																															
<b>Assessment Criteria</b>	<table border="1"> <thead> <tr> <th></th> <th>Quantity</th> <th>Total Contribution (%)</th> </tr> </thead> <tbody> <tr> <td>Midterm</td> <td>2</td> <td>30</td> </tr> <tr> <td>Homework</td> <td>4</td> <td>10</td> </tr> <tr> <td>Assignment</td> <td></td> <td></td> </tr> <tr> <td>Projects</td> <td>1</td> <td>20</td> </tr> <tr> <td>Practice</td> <td></td> <td></td> </tr> <tr> <td>Quiz</td> <td></td> <td></td> </tr> <tr> <td>Contribution of In-term Studies to Overall Grade</td> <td></td> <td>60</td> </tr> <tr> <td>Contribution of Final Examination to Overall Grade</td> <td></td> <td>40</td> </tr> <tr> <td>Attendance</td> <td></td> <td></td> </tr> </tbody> </table>		Quantity	Total Contribution (%)	Midterm	2	30	Homework	4	10	Assignment			Projects	1	20	Practice			Quiz			Contribution of In-term Studies to Overall Grade		60	Contribution of Final Examination to Overall Grade		40	Attendance			
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	Preparing Reports	1	3	3
	Preparing Presentation			
	Presentation			
	Mid-Term and Studying for Mid-Term	2	3	6
	Final and Studying for Final	2	3	6
	Other			
	Total work load			85
	Total work load/25			3.4
	ECTS of the course			3

<b>Course's Contribution To Program</b>	Number	Program Outcomes	1	2	3	4	5
	1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.		X			
	2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.		X			
	3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose. (Realistic constraints and conditions may include factors such as economic and environmental issues, sustainability, manufacturability, ethics, health, safety issues, and social and political issues, according to the nature of the design.)					
	4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.		X			
	5	Ability to design and conduct					

		experiments, gather data, analyze and interpret results for investigating engineering problems.							
	6	Ability to work efficiently in intra-disciplinary teams.			X				
	7	Ability to work efficiently in multi-disciplinary teams;							
	8	Ability to work individually.			X				
	9	Ability to communicate effectively in Turkish, both orally and in writing; Ability to write effective reports and comprehend written reports, make effective presentations,			X				
	10	prepare design and production reports, give and receive clear and intelligible instructions.							
	11	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.		X					
	12	Awareness of professional and ethical responsibility.		X					
	13	Information about business life practices such as project management, risk management, and change management.							
	14	Information about awareness of entrepreneurship, innovation, and sustainable development.		X					
	15	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety.		X					
	16	Knowledge about awareness of the legal consequences of engineering solutions.							
	17	Knowledge on standards used in engineering practice.							

**Name of Lecturer(s) and Contact Information**

1. Prof. Dr. İrfan Ar, irfanar@gazi.edu.tr,
2. Prof.Dr. Göksel Özkan, gozkan@gazi.edu.tr
3. Prof. Dr. N. Alper Tapan, atapan@gazi.edu.tr