

## 1. Course Description

COURSE DESCRIPTION FORM	
Course Code and Title	KM469 ADSORPTION
Course Semester	7
Catalog Description (Content) of the Course	Rate equations and equilibrium relations in adsorption and ion exchange. Determination techniques of properties and structure of sorbents. Design of adsorption and ion exchange columns. Industrial applications.
Main Textbook	Lowell, S., Shields, JE, Thomas, MA, Thommes, M., "Characterization of Porous Solids and Powders: Surface Area, Pore Size, and Density", Kluwer, London, 2004
Supporting Textbooks	1. Yang, R.T., Adsorbents: Fundamental and Applications, Wiley, Newyork, 2003 2. Rouquerol, F., Rouquerol, J., Sing, K., "Adsorption by Powder Porous Solids", Academic Press, Newyork, 1999 3. Do, D.D., "Adsorption Analysis: Equilibrium and Kinetics", Series on Chem. Eng., Vol. 2, Imperial College Press, Signapore, 1998 4. Rutven, D.M., "Principles of Adsorption and Adsorption Processes", Wiley, Newyork, 1984 5. Gregg, S.T., Sing, K.S.W., "Adsorption, Surface Area and Porosity", 2nd Ed., Academic Press, Newyork, 1982 6. Smith, J.M., "Chemical Engineering Kinetics", 3rd ed., Mc Graw-Hill Co., New York, 1981
Course Credit (ECTS)	4
Prerequisites of the Course (Compulsory attendance should be indicated here.)	There is no prerequisite or co-requisite for this course
Type of the Course	Elective
Instruction Language of the Course	Turkish
Object and Target of the Course	- To introduce the place and importance of adsorption and ion exchange in separation proceeses. - Rate and equilibrium relation development in adsorption processes. - Teaching of adsorbent property determination techniques. - Application of thought knowledge to equipment design. - To teach the necessary methods for the engineering applications of related theories.
Learning Outcomes of the Course	- Application of adsorption in separation processes. - Equipment design and engineering application ability. - Gain of written and oral communication skills with the given homework, term project studies.
Mode of Delivery	The mode of delivery of this course is face to face
Weekly Schedule of the Course	1. Week Separation processes and separation with adsorption. Transport phenomena in porous solids. 2. Week Diffusion and determination of effective diffusion coefficient. 3. Week Diffusion and determination of effective diffusion coefficient. 4. Week Separation processes/adsorption by porous materials. 5. Week Separation processes/adsorption by porous materials. 6. Week Separation processes/adsorption by porous materials. 7. Week Separation processes/adsorption by porous materials. 8. Week Separation processes/adsorption by porous materials. 9. Week Characterization of porous adsorbents. 10. Week: Characterization of porous adsorbents. 11. Week: Column design and regeneration methods. 12. Week: Industrial adsorbents and engineering applications. 13. Week: Industrial adsorbents and engineering applications.

	14. Week: Term paper presentation.									
<b>Educative Activities</b> (Credit will be determined based on the time given for these activities. Should be filled carefully.)	Theoretical Study Hours of Course Per Week Reading Searching in Internet and Library Designing and Applying Materials Preparing Reports Preparing Presentation Presentation Mid-Term and Studying for Mid-Term Final and Studying for Final									
<b>Assessment Criteria</b>		<b>Quantity</b>	<b>Total Contribution (%)</b>							
	Midterm	2	45							
	Homework	0	0							
	Assignment	0	0							
	Projects	1	15							
	Practice	0	0							
	Quiz	0	0							
	Contribution of In-term Studies to Overall Grade		60							
	Contribution of Final Examination to Overall Grade		40							
	Attendance									
<b>Workload of the Course</b>	<b>Activity</b>	<b>Total Week Count</b>	<b>Weekly Duration (in hour)</b>	<b>Total Workload in Semester</b>						
	Theoretical Study Hours of Course Per Week	14	3	42						
	Practicing Hours of Course Per Week									
	Reading	5	1	5						
	Searching in Internet and Library	5	3	15						
	Designing and Applying Materials									
	Preparing Reports	1	4	4						
	Preparing Presentation	1	2	2						
	Presentation	1	2	2						
	Mid-Term and Studying for Mid-Term	2	7	14						
	Final and Studying for Final	1	5	5						
	Other									
	Total work load			89						
	Total work load/25			3.56						
	ECTS of the course			4						
<b>Course's Contribution To Program</b>	Number	Program Outcomes	1	2	3	4	5			
	1	Adequate knowledge in mathematics, science and engineering					X			

			subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.						
		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.)		X				
		4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to				X		

			employ information technologies effectively.						
	5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.			X				
	6	Ability to work efficiently in intra-disciplinary teams.						X	
	7	Ability to work efficiently in multi-disciplinary teams			X				
	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.		X					
	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	X						

			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.	X				
	17		Knowledge on standards used in engineering practice.	X				
<b>Name of Lecturer(s) and Contact Information</b>		1. Prof.Dr. Suna Balcı, sbalci@gazi.edu.tr 2. Prof.Dr. Sena Yaşyerli, syasyerli@gazi.edu.tr						