1. Course Description

COURSE DESCRIPTION FORM	
Course Code and Title	KM457 BIOCHEMICAL SEPARATIONS
Course Semester	7
Catalog Description (Content) of the Course	Properties of biochemical substances. Basic bioseparation and purification operations of biomolecules. Filtration. Centrifugation. Extraction. Adsorption. Precipitation. Electrophoresis. Crystallization. Drying.
Main Textbook	• Belter , P. A., E. L. Cussler, and W-S. Hu, 1988, Bioseparations : DownstreamProcessingforBiotechnology, Wiley-Interscience, New York. • Ladisch, M. R., 2001, BioseparationsEngineering : Principles, Practice, andEconomics, , Wiley-Interscience, New York. • Goldberg, E (Editor) , 1997, Handbook of DownstreamProcessing, Chapman&Hall, Cambridge
Recommended Textbooks	• Belter , P. A., E. L. Cussler, and W-S. Hu, 1988, Bioseparations : Downstream Processing for Biotechnology, Wiley-Interscience, New York. • Ladisch, M. R., 2001, Bioseparations Engineering : Principles, Practice, and Economics, , Wiley-Interscience, New York. • Goldberg, E (Editor) , 1997, Handbook of Downstream Processing, Chapman & Hall, Cambridge
Course Credit (ECTS)	4
Prerequisites of the Course (Compulsory attendance should be indicated here.)	There is no prerequisite or corequisite for this course. 70 % attendance is compulsory.
Type of the Course	Elective
Instruction Language of the Course	Turkish
Object and Target of the Course	Comparision of unit operations used in biochemical separation prosesses with unit operations used in chemical industry. Discussion of analogies and differences between them. Classification of unit operations used for purification of biomolecules. Study of different unit operations in each class.
Learning Outcomes of the Course	Developing a chemical engineering approach for the production of biomolecules for which high purities and low production costs are important.
Mode of Delivery	The mode of delivery of this course is face to face.
Weekly Schedule of the Course	1st Week: Introduction 2nd Week: Characterization of biomolecules and bioprocesses 3rd Week: Pre-treatment : Cell distruption, sterilization, flocculation 4th Week: Solid/liquid separations : Filtration 5th Week: Solid/liquid separations : Centrifugation 6th Week: Extraction 7th Week: Extraction 8th Week: Adsorption 9th Week: Precipitation 10th Week: Electrophoresis 11th Week: Crystallization 12th Week: Drying 13th Week: Drying

	14th Week:Evaluation of homeworks and studies of students.
Educative Activities *(Credit will be determined based on the time given for these activities. Should be filled carefully.)*	Weekly theoretical course hours Reading Web survey and library inquiry Midterm exams and preparation for midterm exams Final exam and preparation for final exam

Assessment Criteria

	Quantity	Total Contribution (%)
Midterm	2	40
Homework	2	20
Assignment	0	0
Projects	0	0
Practice	0	0
Quiz	0	0
Contribution of In-term Studies to Overall Grade		60
Contribution of Final Examination to Overall Grade		40
Attendance		

Workload of the Course

Activity	Total Week Count	Weekly Duration (in hour)	Total Workload in Semester
Theoretical Study Hours of Course Per Week	14	3	42
Reading	14	1	14
Searching in Internet and Library	14	1	14
Midterm and Studying for Midterm	4	4	16
Final and Studying for Final	2	5	10
Total work load			96
Total work load/25			3.84
ECTS of the course			4

Course's Contribution To Program

No	Program Learning 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,		X			

			formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.						
		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 employ information technologies effectively.		X				
		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/English, 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 project management, risk management, and change management.	X					
		14	Information about awareness of entrepreneurship, innovation, and sustainable development.	X					
		15	Knowledge about contemporary	X					

			issues and the global and societal effects of engineering practices on health, environment, and safety.						
		16	Knowledge about awareness of the legal consequences of engineering solutions.	X					
		17	Knowledge on standards used in engineering practice	X					
Name of Lecturer(s) and Contact Information	Prof. Dr. Ufuk GÜNDÜZ (ufukgunduz@gazi.edu.tr)								