COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P+L Hour*	*Credits*	*ECTS*
Biomass Energy for Sustainable Development	CE 566	-	3+0+0	3	10

Prerequisites	-

Language of Instruction	English
Course Level	Master's Degree (Second Cycle Programmes)
Course Type	Departmental Elective
Course Coordinator	Asst. Prof. Dr. Börte Köse Mutlu
Instructors	Asst. Prof. Dr. Börte Köse Mutlu
Assistants	-
Goals	The aim of this course is to focus on technologies using biomass and waste as energy resource. It is also aimed that students acquire the knowledge and skills necessary for describing and selecting equipment at a basic level.
Content	Definition of biomass. Nature and types of biomass according to their composition. Sources of biomass. Biomass utilization for energy purposes. Biomass utilization at local and global scale. Characterization and properties. Energy crops & forestry biomass. Supply chain. The combustion process with electricity and heat production. Pyrolysis and gasification processes. Waste to energy. Legislation and regulatory frameworks. Sustainability and the role of biomass energy in sustainable development.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Ability to describe the role of biomass in the context of the energy system at the global and regional scale	2,3,4,9,11	1	A, B, C
2) Ability to list the relevant organizations, major projects at the international level	2,3,4,9,11	1	A, B, C

Teaching Methods:	1: Lecture, 2: Problem solving by instructor, 3: Problem solving assignment
Assessment Methods:	A: Written exam, B: Homework, C: Presentation

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Introduction	Lecture Notes
2	Biomass as energy resource-I	Lecture Notes
3	Biomass as energy resource-II	Lecture Notes
4	Characterization and properties	Lecture Notes
5	Energy crops & forestry biomass	Lecture Notes
6	Supply chain	Lecture Notes
7	Case studies-I	Lecture Notes
8	MIDTERM	-
9	The combustion process with electricity and heat production	Lecture Notes
10	Pyrolysis and gasification processes	Lecture Notes
11	Waste to energy-I	Lecture Notes
12	Waste to energy-II	Lecture Notes
13	Case studies-II	Lecture Notes
14	Legislation and regulatory frameworks	Lecture Notes
15	Sustainability and sustainable development	Lecture Notes

RECOMMENDED SOURCES	
Lecture Notes	The lecture notes are supplied by the instructor.
Textbook	-
Additional Resources	Lorenzini, G., Biserni, C., & Flacco, G. (2010). Solar thermal and biomass energy. Wit Press. Wright, L., Boundy, B., Perlack, B., Davis, S., & Saulsbury, B. (2006). Biomass Energy Data Book, Volume 1. Momba, M. N. B. (Ed.). (2010). Biomass. BoD–Books on Demand. Lowenstein, M. Z. (Ed.). (1985). Energy applications of biomass. CRC Press.

MATERIAL SHARING	
Documents	-
Assignments	-
Exams	Exams questions are solved if demanded.

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Midterm	1	60
Homework	2	20
Term project	1	20
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		50
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		50
Total		**100**

COURSE CATEGORY	Expertise Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	Attains knowledge through wide and in-depth investigations his/her field and surveys, evaluates, interprets, and applies the knowledge thus acquired.						
2	Has a critical and comprehensive knowledge of contemporary engineering techniques and methods of application.				√		
3	By using unfamiliar, ambiguous, or incompletely defined data, completes and utilizes the required knowledge by scientific methods; is able to fuse and make use of knowledge from different disciplines.		√				
4	Has the awareness of new and emerging technologies in his/her branch of engineering profession, studies and learns these when needed.			√			
5	Defines and formulates problems in his/her branch of engineering, develops methods of solution, and applies innovative methods of solution.						
6	Devises new and/or original ideas and methods; designs complex systems and processes and proposes innovative/alternative solutions for their design.						
7	Has the ability to design and conduct theoretical, experimental, and model-based investigations; is able to use judgment to solve complex problems that may be faced in this process.						
8	Functions effectively as a member or as a leader in teams that may be interdisciplinary, devises approaches of solving complex situations, can work independently and can assume responsibility.						
9	Has the oral and written communication skills in one foreign language at the B2 general level of European Language Portfolio.				√		
10	Can present the progress and the results of his investigations clearly and systematically in national or international contexts both orally and in writing.						
11	Knows social, environmental, health, safety, and legal dimensions of engineering applications as well as project management and business practices; and is aware of the limitations and the responsibilities these impose on engineering practices.				√		
12	Commits to social, scientific, and professional ethics during data acquisition, interpretation, and publication as well as in all professional activities						

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	10	140
Midterm	1	3	3
Homework	2	15	30
Term project (Presentation)	1	20	20
Final	1	3	3
Total Work Load			238
Total Work Load / 25 (h)			10
ECTS Credit of the Course			10