BIOLOGICAL NUTRIENT REMOVAL FROM WASTEWATERS

1	Course Title:	BIOLOGICAL NUTRIENT REMOVAL FROM WASTEWATERS
2	Course Code:	CEV4079
3	Type of Course:	Optional
4	Level of Course:	First Cycle
5	Year of Study:	4
6	Semester:	7
7	ECTS Credits Allocated:	3.00
8	Theoretical (hour/week):	2.00
9	Practice (hour/week):	0.00
10	Laboratory (hour/week):	0
11	Prerequisites:	
12	Language:	Turkish
13	Mode of Delivery:	Face to face
14	Course Coordinator:	Doç.Dr. AHMET UYGUR
15	Course Lecturers:	
16	Contact information of the Course Coordinator:	(ahmetuygur@uludag.edu.tr, 0 224 294 21 12, Bursa Uludağ Üniversitesi, Mühendislik Fakültesi, Çevre Mühendisliği Bölümü, 16 059 Görükle/Bursa)
17	Website:	https://sites.google.com/site/docdrahmetuygur/home/dersler/lisans-dersleri/cev-4079
18	Objective of the Course:	The objective of this course is to introduce the principles of both biological nitrogen removal and biological phosphorous removal. Biological processes for carbon, nitrogen and phosphorous removal will be covered with special emphasis on design and operation aspects. Especially, design, operating and reaction kinetics on biological carbon, nitrogen and phosphorous removal are the major topics of this course.
19	Contribution of the Course to Professional Development:	By teaching the students a wide knowledge about biological treatment, they gain many gains in the design, operation and control of organic matter, biological nutrient (nitrogen and phosphorus) removal processes from wastewater.
20	Learning Outcomes:	
	1	Know the description of carbon, nitrogen and phosphorus compounds to be presented in wastewater.
	2	Have the ability of the solving methods of biological degradation and synthesis of present compounds.
	3	Have the ability of cycle theory of carbon, nitrogen and phosphorus compounds.
	4	Have the ability to solve growth kinetics and stoichiometry for nitrification mechanism.
	5	Have the ability to solve growth kinetics and stoichiometry for denitrification mechanism.
	6	Have the ability to solve growth kinetics and stoichiometry for biological phosphorus removal.
	7	Understand the design, operating and environmental parameters for nitrification process.
	8	Understand the design, operating and environmental parameters for denitrification process.
	9	Comprehend the importance of many processes for biological carbon, nitrogen and phosphorus removal.
	10	

21	Course Content:	
	Course Content:	
Week	Theoretical	Practice
1	Carbon, nitrogen and phosphorus compounds in wastewaters.	
2	Cycles of carbon, nitrogen and phosphorus.	
3	Biological processes on nitrogen removal: Nitrification description, nitrification microorganisms, growth kinetics and stoichiometry of bacteria, environmental factors affected nitrification in treatment plants.	
4	Classification of nitrification processes: Separated-recycle processes, combined-recycle processes.	
5	Denitrification description, denitrification microoganisms, growth kinetics and stoichiometry of bacteria, parameters affected denitrification.	
6	Solve the practice problems as regard biological nitrogen removal.	
7	Midterm Exam	
8	Description of Phosphorus removal process, mechanism of phosphorus removal and biological processes, microorganism, growth kinetics and stoichiometry of biological phosphorus removal, systems removed biological enhanced phosphorus, PO4-P release in an anaerobic zone, PO4-P uptake in an aerobic zone.	
9	Biological processes used phosphorus removal: Phostrip processes, phoredox (A/O) process, three-step Phoredox (A2O) process, five-step phoredox process (modified Bardenpho process).	
10	UCT process, Dephanox process, sequencing batch reactor (SBR), Johannesburg process.	
11	Factors affected biological phosphorous removal.	
12	Quiz	
13	Experimental analyses for biological nutrient removal.	
14	Solve the practice problems as regard biological phosphorus removal.	
22	Textbooks, References and/or Other Materials:	Advances in Water and Wastewater Treatment Biological Nutrient Removal, Ann Arbor Science Publishers, Martin P. Wanielista, W. Wesley Echenfelder, 1978, USA. Çevre Mühendisliğinde Biyoprosesler, Prof.Dr. Fikre tKARGI, İzmir, 1993 Design and Retrofit of Wastewater Treatment Plants for Biological Nutrient Removal, C.W. Randall, J.L. Barnav, USA, 1992. Wastewater Engineering Treatment and Reuse, George Tchobanoglous, Franklin L. Burton, H. David Stensel, California, 2003.
23	Assesment	

TERM LEARNING ACTIVITIES	NUMBER	WEIGHT
Midterm Exam	1	30.00
Quiz	1	10.00
Home work-project	0	0.00
Final Exam	1	60.00
Total	3	100.00
Contribution of Term (Year) Learning Activities to Success Grade		40.00
Contribution of Final Exam to Success Grade		60.00
Total		100.00
Measurement and Evaluation Techniques Used in the Course		MIDTERM, SHORT EXAM, FINAL EXAM

24 ECTS / WORK LOAD TABLE

Activites	Number	Duration (hour)	Total Work Load (hour)
Theoretical	14	2.00	28.00
Practicals/Labs	0	0.00	0.00
Self study and preperation	14	4.00	56.00
Homeworks	0	0.00	0.00
Projects	0	0.00	0.00
Field Studies	0	0.00	0.00
Midterm exams	1	2.00	2.00
Others	0	0.00	0.00
Final Exams	1	2.00	2.00
Total Work Load			88.00
Total work load/ 30 hr			2.93
ECTS Credit of the Course			3.00

25 CONTRIBUTION OF LEARNING OUTCOMES TO PROGRAMME QUALIFICATIONS

	PQ1	PQ2	PQ3	PQ4	PQ5	PQ6	PQ7	PQ8	PQ9	PQ10	PQ11	PQ12	PQ13	PQ14	PQ15	PQ16
ÖK1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK2	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
ÖK3	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK4	0	4	5	0	5	0	0	0	0	0	0	0	0	0	0	0
ÖK5	0	4	5	0	5	0	0	0	0	0	0	0	0	0	0	0
ÖK6	0	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK7	5	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0
ÖK8	0	5	0	0	4	0	0	0	0	0	0	0	0	0	0	0

ÖK9	5	0	5	0	4	0	0	0	0	0	0	0	0	0	0	0

LO: Learning Objectives PQ: Program Qualifications					
Contribution Level:	**1 very low**	**2 low**	**3 Medium**	**4 High**	**5 Very High**