

**GAZİ UNIVERSITY  
ENGINEERING FACULTY  
CHEMICAL ENGINEERING DEPARTMENT  
2019-2020 I. SEMESTER**

**INFORMATION ABOUT COURSE**

**Course Code and Title :**CHE 481 CHEMICAL ENGINEERING LABORATORY II

**Section:**Ing

**Coordinator Faculty Member:** Prof.Dr. Göksel ÖZKAN

**Office Number:** 515 **E-mail:**gozkan@gazi.edu.tr

**Laboratory Program:** NÖ-01 Wednesday (09:30-13:20)  
NÖ-03 Friday (13:30-17:20)

**Laboratory Documents:**Laboratory course sheets are available at the address below.

<http://mf-km.gazi.edu.tr/posts/view/title/laboratuar-dersleri-30251>

**Course Content:**

Laboratory applications of heat and mass transfer, chemical reaction engineering principles. Instrumental analysis and experiments with applied technology. Evaluation of experimental data and results.Presentation in a report.Special evaluation.

**Textbook and Supplementary Materials:**

Experiment sheets containing some basic aspects and all library and Web facilities. Textbooks about heat and mass transfer, chemical reaction engineering.

**Objectives of the Course:**

Learning of physicochemical analysis, heat and mass transfer and kinetic concepts with experimental studies;group work, designing experiments, conducting experiments, getting results and interpreting and developing scientific report writing skills.

**Course Outcomes:**

- 1) To learn the laboratory applications of the concepts taught in basic chemical engineering courses.
- 2) To gain the ability of using laboratory devices.
- 3) Evaluating the experimental findings, examining the results and presenting them in a report, gaining the skills to work in disciplinary groups.

**Evaluation Criteria**

***Determination of Course Grade***

- Written and / or oral exams are done by the instructor before and after the experiment. During the experiment, the student's interest is evaluated as a performance grade. The grade determined by taking these into consideration affects the course grade by 20%.
- For each experiment, each group must submit a single report written at the request of the experimentinstructor. These reports are evaluated by the instructor and a correction is requested when necessary. The report grade has a 50% effect on the semester-end grade.

**The calculation of the course grade is given below:**

**Semester-end-grade = 0,20 (Exam before and after the experiment + Performance) + 0,50 Report Grade + 0,30 Final exam grade**

Experiment Number	Experiment Name	Ing Tuesday 09:30-13:20
1a	Water and Waste Water Technologies	S. F. MUTLU
1b	Oil Analysis	-
2a	Liquid Fuels	N. DİLSİZ
2b	Solid Fuels	-
3a	Seed Oils Analysis	F. TURGUT
3b	Fertilizer Analysis	-
4a	Pressure Drop in Packed Column	D. U. ZIRAMAN
4b	Double pipe heat exchanger	-
5a	Continuous stirred tank reactor	A. TAPAN
5b	Diffusion	-

### General Rules :

For CHE481 Chemical Engineering Laboratory II course, the student must have successfully completed all experiments. Students are required to attend at least 80% of the laboratory, complete all experiments and submit their reports on time. In case of late submission of reports, 5 points will be reduced from the report grade for each day. Students who cannot come to the laboratory are compensated for a maximum of two experiments provided that their valid excuse is documented to the coordinator faculty member.

Each student is expected to make the theoretical and practical preparation of the experiment within the week before the experiment and must meet with the responsible instructor for the experiment at least three days before the experiment. Otherwise, the performance grade will be reduced by 5 points. It is the student's responsibility to carry out the theoretical research, to examine the experimental system in the laboratory, to learn the method of the experiment, how to obtain data by determining the changing parameters.

The grouped tests specified in the table above will be carried out in accordance with the program. The names and programs of the obligatory experiments are given in the tables above. The groups are responsible for only one of the experiments in the specified group. The groups design the related experiments under the supervision of the instructor and perform the experiment by determining the experimental parameters.

At the beginning of the experiment, the student's preparation for the experiment will be evaluated with the quiz. In case of failure, the student will not be able to conduct the experiment. Students who fail three times will automatically fail from this laboratory with the grade (D). Students who fail at most twice the quizzes will compensate for their experiments in the last two weeks.

## Report Layout

The experiment report should cover the following sections and should be submitted to the instructor in the following week.

COVER PAGE
ABSTRACT (10 %)
CONTENTS
LIST OF FIGURES
LIST OF TABLES
1. THEORY (10 %)
2. EXPERIMENTAL PROCEDURE (5 %)
2.1. EXPERIMENTAL DATA
3. CALCULATIONS (25 %)
4. RESULTS AND DISCUSSION (25 %)
5. CONCLUSION (10 %)
6. RECOMMENDATION (5 %)
7. NOMENCLATURE
8. REFERENCES
APPENDIX
OVERVIEW (10 %)

**Cover Page:** The name and number of the experiment, the names of the students, their numbers and groups, the name of the responsible instructor, the date of the experiment and the date of the submission of the report should be indicated.

**Abstract:** The purpose of the experiment, the characteristics of the devices used, the experiment conditions and parameters, the important results obtained (numerical and non-numerical) should be given. The abstract should answer the following questions in a very concise way; What has been done? How was it made? What was found? Which results have been achieved?

**Theory:** In preparation for the experiment, you are expected to read the theory of the experiment. In this part of your report, you are also expected to provide information that is directly related to the experiment and helps you with your calculations, rather than general information.

**Experimental Procedure:** The apparatus used (with a schematic drawing of the system) and the method should be described.

**Experimental Data:** The data obtained as a result of the experiments should be given as a table.

**Calculations:** A sample calculation should be given in detail in this section. Each student in the group will carry out these calculations themselves. Only one of them will be given in this section. The calculations of the other students will be given in the Appendix with their names written on them.

**Results and Discussion:** The numerical findings obtained at the end of the calculations should be presented in tables and/or figures in this section. The findings are discussed and interpreted experimentally and theoretically. How the findings change with the experimental parameters, whether they are compatible with the theoretical expectations are indicated and examined. Experimental errors are mentioned. (In cases where the results are not compatible with the theory, it is not enough to say experimental errors as the only reason.)

**Conclusion:** The results obtained after the experiment are briefly mentioned more qualitatively. For example, how an experimental or dimensionless parameter affects the performance and findings of the system is indicated. It is necessary to avoid giving numerical results (Findings) in this section unless necessary.

**Recommendations:** It is stated how to operate the test apparatus better and more efficiently, what can be done to reduce the experimental errors, what other work can be done with the present apparatus.

**Nomenclature:** What all symbols and variables used in the report mean and their units in the SI system are listed in alphabetical order.

**References :**References should be cited as given in the literature and as in the examples below.

*Book:* Seborg D.E., Edgar T.F., Mellichamp D.A., Process Dynamics and Control, 2nd Edition, Wiley, NY, 50-55, 2004.

*Journal Publication:* Correia, V.M., Stephenson, T., Judd, S.J., "Characterization of textile wastewaters- A Review", Environmental Technology, 15:917-929, 1994.

- Congress paper:* Sekhtira, A., Lee, Y.Y. and Genetti, W.E., “Heat Transfer in a Circulating Fluidized Bed”, Proc. of the 25th National Heat Transfer Conf., Houston, Texas, 24-27 July, 1988.
- Chapter in An Edited Book:* Gökçay, C.F., Sağ, Y., “Endüstriyel Uygulamalar”, Endüstriyel Atıksu Arıtımı, 1. Baskı, Kimya Mühendisleri Odası, Ankara Şubesi, 310-317 (1992).
- Thesis:* Kayacan, İ., “Alçak ve Yüksek Yoğunluklu Polietilen Atıkların Pirolizi”, Yüksek Lisans Tezi, Gazi Üniversitesi, Fen Bilimleri Enstitüsü, Ankara, Aralık 2002.

## Rapor Düzeni

Deney raporu aşağıda belirtilen bölümleri kapsamalı ve deneyi takip eden bir sonraki hafta ilgili öğretim üyesine teslim edilmelidir.

KAPAK SAYFASI	
ÖZET (% 10)	
İÇİNDEKİLER	
ŞEKİLLERİN LİSTESİ	
ÇİZELGELERİN LİSTESİ	
1. TEORİK BİLGİLER	(% 10)
2. DENEYİN YAPILIŞI	(% 5)
2.1.VERİLER	
3. HESAPLAMALAR	(% 25)
4. BULGULAR VE TARTIŞMA	(% 25)
5. SONUÇLAR	(% 10)
6. ÖNERİLER	(% 5)
7. SEMBOLLER	
8. KAYNAKLAR	
EKLER	
GENEL GÖRÜNÜM (% 10)	

**Kapak Sayfası :** Deneyin adı ve numarası, öğrencilerin isimleri, numaraları ve grupları, sorumlu öğretim üyesinin ismi, deneyin yapıldığı tarih ve raporun teslim edildiği tarih belirtilmelidir.

**Özet :** Deneyin amacı, kullanılan cihaz(lar)ın karakteristik özellikleri, deney koşulları ve parametreleri, elde edilen önemli sonuçlar (sayısal ve sayısal olmayan) verilmelidir. Özet, şu sorulara çok kısa ve öz bir şekilde cevap vermelidir; *Ne yapılmıştır? Nasıl yapılmıştır? Ne bulunmuştur? Hangi sonuçlara ulaşılmıştır?*

**Teorik Bilgiler :** Deney öncesi hazırlığımızda, sizden deneye ait teoriyi okumanız beklenmektedir. Raporunuzun bu kısmında da genel bilgiler yerine, yapılan deneyle doğrudan ilgili ve hesaplamalarınızda size yardımcı olan bilgileri vermeniz beklenmektedir.

**Deneyin Yapılışı :** Kullanılan düzenek (sistemin şematik bir çizimi de verilerek) ve yöntem anlatılmalıdır.

**Veriler:** Deneylerin sonucunda elde edilen veriler çizelge olarak verilmelidir.

**Hesaplamalar :** Bu kısımda örnek bir hesap detaylı olarak verilmelidir. Gruptaki her öğrenci bu hesaplamaları kendi yapacaktır. Bunlardan sadece bir tanesi bu kısımda verilecektir. Diğer öğrencilerin yaptığı hesaplamalar, üzerlerinde isimleri yazılı olarak, Ekler kısmında verilecektir.

**Bulgular ve Tartışma:** Hesaplamaların sonunda elde edilen sayısal bulgular bu kısımda çizelge ve/veya şekil halinde sunulmalıdır. Elde edilen bulgular deneysel ve teorik olarak tartışılıp, yorumu yapılır. Bulguların deneysel parametrelerle nasıl değiştiği, teorik beklentilerle uyumlu olup olmadığı belirtilir ve irdelenir. Varsa deneysel hatalardan bahsedilir. (Sonuçların teori ile uyumlu olmadığı durumlarda, tek neden olarak deneysel hataları söylemek yeterli değildir.)

**Sonuçlar :** Deney sonrasında ve tartışmanın ışığında elde edilen sonuçlar daha çok kalitatif olarak kısaca belirtilir. (Örneğin, bir deneysel veya boyutsuz parametrenin sistemin performansına ve bulgulara nasıl etki ettiği belirtilir. Mecbur olmadıkça bu kısımda sayısal sonuçlar (Bulgular) vermektan kaçınmak gerekir.

**Öneriler :** Deney düzeneğinin nasıl daha iyi ve verimli çalıştırılabileceği, deneysel hataların azaltılabilmesi için neler yapılabileceği, mevcut düzenek ile başka ne gibi bir çalışmanın yapılabileceği belirtilir.

**Semboller :** Raporda kullanılan tüm semboller ve değişkenlerin ne anlama geldiği ve SI sistemindeki birimleri alfabetik liste halinde verilir.

**Kaynaklar :** Yararlanılan kaynaklar literatürde verilmiş şekliyle ve aşağıdaki örneklerde olduğu gibi verilmelidir.

**Kitap :** Seborg D.E., Edgar T.F., Mellichamp D.A., Process Dynamics and Control, 2nd Edition, Wiley, NY, 50-55, 2004.

**Makale :** Correia, V.M., Stephenson,T., Judd,S.J., "Characterisation of textile wastewaters-A Review", Environment Technology, 15:917-929, 1994.

**Bildiri :** Sekhtira, A., Lee, Y.Y. and Genetti, W.E., "Heat Transfer in a Circulating Fluidized Bed", Proc. of the 25<sup>th</sup> National Heat Transfer Conf., Houston, Texas, 24-27 July, 1988.

**Kitapta Bölüm :** Gökçay,C.F., Sağ, Y., "Endüstriyel Uygulamalar", Endüstriyel Atıksu Arıtımı, 1.baskı, Kimya Mühendisleri Odası, Ankara Şubesi, 310-317 (1992).

**Tez :** Kayacan, İ., "Alçak ve Yüksek Yoğunluklu Polietilen Atıkların Pirolyzi", Yüksek Lisans Tezi, Gazi Üniversitesi, Fen Bilimleri Enstitüsü, Ankara, Aralık 2002.

**Ekler :** Hesaplamalarda kullanılan fizikokimyasal özellikler, nomogramlar.