DERS BİLGİ FORMU

FAKÜLTE / ENSTİTÜ ADI	**Fen Edebiyat Fakültesi**
BÖLÜM / PROGRAM / ANABİLİM DALI ADI	**Kimya**
DERSİN ADI	**Endüstriyel Organik Bileşiklerde Toksikoloji**
DERSİN KODU	**KIM4151**
YEREL KREDİSİ	**3**
AKTS KREDİSİ	**5**
HAFTALIK DERS SAATİ	**3**
HAFTALIK UYGULAMA SAATİ	**0**
HAFTALIK LABORATUVAR SAATİ	**0**
ÖNKOŞULLAR	**Yok**
YARIYIL	**Güz**
DERSİN DİLİ	**Türkçe**
DERSİN SEVİYESİ	**Lisans**
DERSİN TÜRÜ	**Seçmeli @Kimya Lisans Programı**
DERSİN KATEGORİSİ	**Temel Meslek Dersleri**
DERSİN VERİLİŞ ŞEKLİ	**Yüz Yüze**
DERSİ SUNAN AKADEMİK BİRİM	**Kimya Bölümü**
DERSİN KOORDİNATÖRÜ	**Huriye AKDAŞ KILIÇ**
ASİSTAN(LAR)	
DERSİN AMACI	Bu dersin amacı, öğrencilere toksikoloji ile ilgili temel kavramların ve günümüzde yaygın olarak kullanılan kimyasalların insan ve çevre sağlığına zararlı etkilerinin ve bunlara karşı alınacak önlemlerin öğretilmesidir.
DERSİN İÇERİĞİ	Toksikoloji tanımı, tarihçesi ve gelişimi; toksik maddelerin sınıflandırılması; toksikoloji ile ilgili temel kavramlar; toksisite testleri, kimyasalları kullanırken bilinmesi gerekenler; tehlikeli kimyasalların ölçüm yöntemleri; tehlikeli kimyasallar; toksik maddelerin biyolojik sistemlerle etkileşimleri; kimyasallara karşı alerjik reaksiyonlar; endüstride kullanılan toksik maddeler; zararlı pestisitler; kimyasal ve farmasötik atıklar ve bertaraf edilmeleri; laboratuvar atıkları ve bertaraf edilmeleri.
DERS KİTABI / MALZEMESİ / ÖNERİLEN KAYNAKLAR	**Ders Kitapları:** 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.).

	Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
Ders Öğrenim Çıktıları	Bu dersi başarıyla tamamlayan öğrenciler; 1. Toksikoloji ile ilgili temel kavramlar hakkında bilgi sahibi olabileceklerdir. 2. Günümüzde yaygın olarak kullanılan kimyasalların insan ve çevre sağlığına zararlı etkilerini ve bunlara karşı alınacak önlemleri kavrayabileceklerdir. 3. Toksik maddeleri öğrenecek ve bunların kontrol altına alınması hakkında bilgi sahibi olabileceklerdir. 4. Çevre bilinci kazanabileceklerdir. 5. Mesleki ve etik sorumluluk bilincine sahip olabileceklerdir.

DEĞERLENDİRME SİSTEMİ

Etkinlikler	**Sayı**	**Katkı Payı**
Devam/Katılım: • **İçerik:** Öğrencilerin derslere devam etmeleri ve katılmaları • **Detaylı Değerlendirme Kriterleri:**		
Laboratuvar:		
Uygulama (Sözlü Sınav):		
Arazi Çalışması		
Derse Özgü Staj		
Kısa Sınavlar/Stüdyo Kritiği (Zorunlu): 1. **İçerik:** Sınav haftasına kadar işlenen konuların tümünü kapsayan kapsamlı soruların sorulması • **Format:** Yüz yüze. Çoktan seçmeli ya da klasik kısa sınav (5-10 dakika) • **Detaylı Değerlendirme Kriterleri:** - toksik maddeleri ait dersteki bilgileri uygulayabilme	**2**	**%10**
Ödev:		
Sunum/Jüri:		
Proje:		
Seminer/Workshop		
Ara Sınavlar: • **İçerik:** Sınav haftasına kadar işlenen konuların tümünü kapsayan kapsamlı sorular • **Format:** Yüz yüze Sınav (90 dakika) • **Detaylı Değerlendirme Kriterleri:** - Derste işlenen teorik bilgileri kullanarak ilgili analiz problemlerini çözebilme	**1**	**%25**
- **Ödev** • **İçerik:** Proje sunumlari	**1**	**%25**

• **Format:** Yüz yüze Sunum • **Detaylı Değerlendirme Kriterleri:** - Bilimsel makaleyi okuma, anlama ve powerpoint sunum halinde özetleme		
Final: • **İçerik:** Dersin tüm içeriğini kapsayan kapsamlı sorular • **Format:** Yüz yüze Sınav (110 dakika) • **Detaylı Değerlendirme Kriterleri:** - Endüstride kullanılan toksik maddeler üzerinde elde edilen verileri kullanma ve yorumlayabilme becerisi	**1**	**%40**
Dönem İçi Çalışmaların Başarı Notuna Katkısı		**%60**
Final Sınavının Başarı Notuna Katkısı		**%40**
TOPLAM		**%100**

HAFTALIK KONULAR VE İLGİLİ ÖN HAZIRLIK ÇALIŞMALARI

HAFTALAR	KONULAR	Ön Hazırlık
1	**Konu Anlatımı:** Toksikoloji tanımı, tarihçesi ve gelişimi	1. Toksikoloji tanımı, tarihçesi ve gelişimi. Kaynaklar: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
2	**Konu Anlatımı:** Giriş ve Temel Kavramlar, Toksikolojinin tanımı, endüstrideki önemi **Sınıf-içi Uygulama (15 dk.):** MSDS (Güvenlik Bilgi Formu) incelemesi – benzen örneği üzerinden	1. Giriş ve Temel Kavramlar, Toksikolojinin tanımı, endüstrideki önemi. Kaynaklar: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6.

		Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
3	**Konu Anlatımı:** Toksikokinetik (ADME), Teori: Emilim, dağılım, metabolizma ve atılım, Ölçüm: Biyolojik örneklerde metabolit analizi yöntemleri (HPLC, GC-MS) **Sınıf-içi Uygulama (15 dk.):** toksisite testlerden örnekler	1. Toksikokinetik (ADME), Teori: Emilim, dağılım, metabolizma ve atılım, Ölçüm: Biyolojik örneklerde metabolit analizi yöntemleri (HPLC, GC-MS). Kaynaklar: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
4	**Konu Anlatımı**: Toksikodinamik, Moleküler düzeyde toksisite mekanizmaları **Sınıf-içi Uygulama (15 dk.):** toksisite testlerden örnekler	1. Toksikodinamik, Moleküler düzeyde toksisite mekanizmaları. Kaynaklar: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014).

		Handbook of Toxicology (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
5	**Konu Anlatımı:** Doz–Yanıt İlişkileri ve Toksisite Parametreleri, Teori: LD_{50}, LC_{50}, akut–kronik toksisite **Sınıf-içi Uygulama (15 dk.):** toksisite testlerden örnekler	1. Doz–Yanıt İlişkileri ve Toksisite Parametreleri, Teori: LD_{50}, LC_{50}, akut–kronik toksisite. Kaynaklar: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
6	**Konu Anlatımı:** Aromatik Hidrokarbonlar (BTX: Benzen, Toluen, Ksilen), Yapı–etki ilişkileri, hematotoksisite, Ölçüm: Hava örneklerinde BTX analizi (GC, pasif örnekleme), Aktif karbon adsorpsiyonu, katalitik oksidasyon **Sınıf-içi Uygulama (15 dk.):** toksisite testlerden örnekler	1. Aromatik Hidrokarbonlar (BTX: Benzen, Toluen, Ksilen), Yapı–etki ilişkileri, hematotoksisite, Ölçüm: Hava örneklerinde BTX analizi (GC, pasif örnekleme), Aktif karbon adsorpsiyonu, katalitik oksidasyon. Kaynaklar: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
7	**Konu Anlatımı:** Halojenli Organik Bileşikler**,** Klorlu çözücüler, PCB'ler, dioksinler**,** GC-ECD ile PCB analizi, dioksin tayini,	1. Halojenli Organik Bileşikler**,** Klorlu çözücüler, PCB'ler, dioksinler**,** GC-ECD ile

	Yüksek sıcaklıkta yakma, ileri oksidasyon prosesleri (Fenton, ozonlama) **Sınıf-içi Uygulama (15 dk.):** toksisite testlerden örnekler **Kısa sınav 1 (15 dakika):** İlk 6 hafta işlenen konularla ilgili kısa sınav yapılması	PCB analizi, dioksin tayini**,** Yüksek sıcaklıkta yakma, ileri oksidasyon prosesleri (Fenton, ozonlama). Kaynaklar: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
8	**Ara Sınav 1**	Sınav haftasına kadar işlenen konuların tekrar edilmesi
9	**Konu Anlatımı:** Nitrosaminler ve Aromatik Aminler**,** DNA alkilasyonu, mutajenite**,** HPLC-UV, LC-MS/MS ile nitrosamin tayini**,** Fotokatalitik oksidasyon, biyolojik parçalanma zorlukları **Sınıf-içi Uygulama (15 dk.):** toksisite testlerden örnekler	1. Nitrosaminler ve Aromatik Aminler**,** DNA alkilasyonu, mutajenite**,** HPLC-UV, LC-MS/MS ile nitrosamin tayini**,** Fotokatalitik oksidasyon, biyolojik parçalanma zorlukları. Kaynaklar: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
10	**Konu Anlatımı:** Pestisitler, Organofosfatlar, karbamatlar, organoklorlular**,** Gıda ve su örneklerinde pestisit analizi (GC-MS, QuEChERS yöntemi)**,** Toprak yıkama, biyoremediasyon, yakma yöntemleri **Sınıf-içi Uygulama (15 dk):** toksisite testlerden örnekler	1. Pestisitler, Organofosfatlar, karbamatlar, organoklorlular**,** Gıda ve su örneklerinde pestisit analizi (GC-MS, QuEChERS yöntemi)**,** Toprak yıkama, biyoremediasyon, yakma yöntemleri. Kaynaklar: 1. Klaassen, C. D. (Ed.). (2013).

		Casarett and Doull's Toxicology: The Basic Science of Poisons (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
11	**Konu Anlatımı:** Poliaromatik Hidrokarbonlar (PAH'lar), Yanma ürünleri, karsinojenite**,** Hava/katı örneklerde PAH analizi (HPLC-FLD, GC-MS)**,** Termal oksidasyon, UV/Fenton oksidasyonu **Sınıf-içi Uygulama (15 dk):** toksisite testlerden örnekler	1. Poliaromatik Hidrokarbonlar (PAH'lar), Yanma ürünleri, karsinojenite**,** Hava/katı örneklerde PAH analizi (HPLC-FLD, GC-MS)**,** Termal oksidasyon, UV/Fenton oksidasyonu. Kaynaklar: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
12	**Konu Anlatımı:** Endüstriyel Çözücüler ve Plastik Katkıları**,** Formaldehit, stiren, ftalatlar, BPA**,** FTIR, GC-MS ile plastik katkı maddesi tayini, Yeni Organik Malzemeler ve Nanotoksikoloji**,** Nanopolimerler, karbon nanotüpler, grafen**,** DLS, TEM/SEM ile nanoparçacık tayini**,** Filtrasyon, membran sistemleri, fotokatalitik yöntemler **Sınıf-içi Uygulama (15 dk):** Plastiklerde ftalat sızıntısı literatür analizi **Kısa sınav 2 (15 dakika):** 9-11. hafta işlenen konularla ilgili kısa sınav yapılması	1. Endüstriyel Çözücüler ve Plastik Katkıları**,** Formaldehit, stiren, ftalatlar, BPA**,** FTIR, GC-MS ile plastik katkı maddesi tayini, Yeni Organik Malzemeler ve Nanotoksikoloji**,** Nanopolimerler, karbon nanotüpler, grafen**,** DLS, TEM/SEM ile nanoparçacık tayini**,** Filtrasyon, membran sistemleri, fotokatalitik yöntemler. Kaynaklar: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A*

		Textbook of Modern Toxicology (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
13	**Arasınav 2**	Sınav haftasına kadar işlenen konuların tekrar edilmesi
14	**Konu Anlatımı:** Proje Sunumları ve Değerlendirme Öğrenci projeleri: alanda örnekler üzerinde makale örnekleri	Proje Sunumları ve Değerlendirme
15	**Konu Anlatımı:** Proje Sunumları ve Değerlendirme Öğrenci projeleri: alanda örnekler üzerinde makale örnekleri	Proje Sunumları ve Değerlendirme
16	**Final**	Tüm konuların gözden geçirilmesi

AKTS İŞYÜKÜ TABLOSU

Etkinlikler	Sayı	Süresi (Saat)	Toplam İşyükü
Ders Saati	**13**	**3**	**39**
Laboratuar			
Uygulama (sözlü Sınav)			
Arazi Çalışması			
Sınıf Dışı Ders Çalışması	**13**	**5**	**65**
Derse Özgü Staj			
Ödev			
Küçük Sınavlar/Stüdyo Kritiği	**2**	**3**	**6**
Projeler			
Sunum / Seminer	**1**	**7**	**14**
Ara Sınavlar (Sınav Süresi + Sınav Hazırlık Süresi)	**2**	**6**	**12**
Final (Sınav Süresi + Sınav Hazırlık Süresi)	**1**	**13**	**13**
Toplam İş yükü:			**149**
Toplam İş yükü / 30(s):			**4.97**
AKTS Kredisi:			**5**

COURSE INFORMATION FORM

FACULTY / GRADUATE SCHOOL	**Faculty of Arts and Sciences**
DEPARTMENT / PROGRAMME	**Chemistry**
TITLE OF COURSE	**Toxicology of Industrial Organic Compounds**
CODE	**KIM4151**
LOCAL CREDIT	**3**
ECTS	**5**
LECTURE HOUR / WEEK	**3**
PRACTICAL HOUR / WEEK	**0**
LABORATORY HOUR / WEEK	**0**
PREREQUISITE	**None**
SEMESTER	**Spring**
COURSE LANGUAGE	**English, Turkish**
LEVEL OF COURSE	**Undergraduate**
COURSE TYPE	**Elective @ Bachelor Programme in Chemistry**
COURSE CATEGORY	**Core Courses**
MODE OF DELIVERY	**Face-to-Face**
OWNER ACADEMIC UNIT	**Department of Chemistry**
COURSE COORDINATOR	**Huriye AKDAŞ KILIÇ**
ASSISTANT(S)	
COURSE OBJECTIVES	The aim of this course is to teach students the basic concepts of toxicology, the harmful effects of commonly used chemicals on human and environmental health, and the precautions to be taken against them.
COURSE CONTENT	Definition, history and development of toxicology; classification of toxic substances; basic concepts related to toxicology; toxicity tests, things to know when using chemicals; measurement methods of hazardous chemicals; hazardous chemicals; interactions of toxic substances with biological systems; allergic reactions to chemicals; toxic substances used in industry; hazardous pesticides; chemical and pharmaceutical wastes and their disposal; laboratory wastes and their disposal.
RECOMMENDED OR REQUIRED READINGS	**Coursebooks:** 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press.

	10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
Course Learning Outcomes	Upon successful completion of the course, students will be able to 1. Learn about the basic concepts of toxicology. 2. Understand the harmful effects of commonly used chemicals on human and environmental health and the precautions to be taken against them. 3. Learn about toxic substances and how to control them. 4. Gain environmental awareness. 5. Develop a sense of professional and ethical responsibility.

EVALUATION SYSTEM

Activities	Number	Percentage of Grade
Attendance/Participation: • **Content:** Student attendance and participation in the course. • **Detailed Assessment Criteria:** -Active participation in lessons and asking questions -Ability to contribute to in-class discussions and problem-solving processes		
Laboratory		
Application (Oral Examination): • **Content:** Students will be asked to explain fundamental concepts of Toxicology of Industrial Organic Compounds and to propose a solution to a practical problem. • **Format:** Individual oral examination with each student (5-10 minutes). • **Detailed Assessment Criteria:** -Ability to explain concepts -Ability to solve problems -Ability to articulate problem solutions		
Field Work		
Special Course Internship (Work Placement)		
Quizzes/Studio Critics: 12. **Content:** Comprehensive questions covering all topics addressed up to the exam week • **Format:** Face-to-face multiple-choice quiz (5-10 minutes) • **Detailed Assessment Criteria:** -Ability to solve problems related to the theoretical topics covered in the course	**2**	**%10**
Homework Assignments: • **Content:** Weekly assignments requiring critical analysis of fundamental concepts covered in class and identification of examples of these concepts within both intra-disciplinary and interdisciplinary contexts • **Format:** Written reports and group presentations	**1**	**%25**

• **Detailed Assessment Criteria:** -Ability to logically and accurately demonstrate the problem-solving process -Ability to find practical examples of the concepts - Ability to carry out processes of applied thinking, interpretation, and justification		
Presentations/Jury: • **Content:** Students will be asked to evaluate their own learning processes and deliver group presentations • **Format:** Group presentations • **Detailed Assessment Criteria:** -Ability to accurately explain the topics learned -Proper use of presentation techniques		
Project: • **Content:** Students will be asked to write a project proposal (TÜBİTAK 2209 A/B) to be submitted at the end of the academic term. • **Format:** Written reports and group presentations • **Detailed Assessment Criteria:** -Ability to identify an original research topic -Ability to write a research proposal in accordance with scientific principles and relevant guidelines		
Seminar/Workshop		
Midterms: • **Content:** Comprehensive questions covering all topics addressed up to the exam week • **Format:** Face-to-face written exam. (90 minutes). • **Detailed Assessment Criteria:** -Demonstration of understanding of the fundamental concepts of the course -Ability to solve problems related to theoretical topics -Ability to carry out theoretical reasoning processes	**1**	**%25**
Final: • **Content:** Comprehensive questions covering the entire content of the course • **Format:** Face-to-face written exam. (90 minutes). • **Detailed Assessment Criteria:** -Ability to apply advanced problem-solving skills -Demonstration of a thorough understanding of all topics covered in the course	**1**	**%40**
Percentage of In-Term Studies		**%60**
Percentage of Final Examination		**%40**
TOTAL		**%100**

WEEKLY SUBJECTS AND RELATED PREPARATION STUDIES

WEEKS	COURSE OUTLINE	Related Preparation
1	**Lecture:** Definition, history and development of toxicology	1. Definition, history and development of toxicology. Sources: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
2	**Lecture:** Introduction and Basic Concepts, Definition of Toxicology, Its Importance in Industry **Quick Practice (15 minutes):** MSDS (Safety Data Sheet) review – using benzene as an example	1. Introduction and Basic Concepts, Definition of Toxicology, Its Importance in Industry. Sources: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
3	**Lecture**: Toxicokinetics (ADME), Theory: Absorption, distribution, metabolism and excretion, Measurement: Methods for metabolite analysis in biological samples (HPLC, GC-MS) **Quick Practice (15 minutes):** Examples of toxicity tests	1. Toxicokinetics (ADME), Theory: Absorption, distribution, metabolism and excretion, Measurement: Methods for metabolite analysis in biological samples (HPLC, GC-MS). Sources: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta,

		C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
4	**Lecture:** Toxicodynamics, mechanisms of toxicity at the molecular level **Quick Practice (15 minutes):** Examples of toxicity tests	1. Toxicodynamics, mechanisms of toxicity at the molecular level. Sources: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
5	**Lecture:** Dose–Response Relationships and Toxicity Parameters, Theory: LD_{50}, LC_{50}, acute–chronic toxicity **Quick Practice (15 minutes):** Examples from toxicity tests	1. Dose–Response Relationships and Toxicity Parameters, Theory: LD_{50}, LC_{50}, acute–chronic toxicity. Sources: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
6	**Lecture:** Aromatic Hydrocarbons (BTX: Benzene, Toluene, Xylene), Structure–activity relationships, hematotoxicity, Measurement: BTX analysis in air samples (GC, passive sampling), Activated carbon adsorption, catalytic oxidation **Quick Practice (15 minutes):** Examples from toxicity tests	1. Aromatic Hydrocarbons (BTX: Benzene, Toluene, Xylene), Structure–activity relationships, hematotoxicity, Measurement: BTX analysis in air samples (GC, passive sampling), Activated carbon adsorption, catalytic oxidation. Sources: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.).

		CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
7	**Lecture:** Halogenated Organic Compounds, Chlorinated Solvents, PCBs, Dioxins, PCB Analysis with GC-ECD, Dioxin Determination, High Temperature Incineration, Advanced Oxidation Processes (Fenton, Ozonation) **Quick Practice (15 minutes):** Examples from toxicity tests **Quiz 1 (15 minutes):** A short exam on the topics covered in the first 6 weeks	1. Halogenated Organic Compounds, Chlorinated Solvents, PCBs, Dioxins, PCB Analysis with GC-ECD, Dioxin Determination, High Temperature Incineration, Advanced Oxidation Processes (Fenton, Ozonation). Sources: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
8	**Midterm 1**	Review of all topics covered up to the exam week.
9	**Lecture:** Nitrosamines and Aromatic Amines, DNA alkylation, mutagenicity, determination of nitrosamines by HPLC-UV, LC-MS/MS, Photocatalytic oxidation, biodegradation challenges **Quick Practice (15 minutes):** Examples from toxicity tests	1. Nitrosamines and Aromatic Amines, DNA alkylation, mutagenicity, determination of nitrosamines by HPLC-UV, LC-MS/MS, Photocatalytic oxidation, biodegradation challenges. Sources: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
10	**Lecture:** Pesticides, Organophosphates, carbamates, organochlorines, Pesticide analysis in food and water samples (GC-MS, QuEChERS method), Soil washing, bioremediation, incineration methods **Quick Practice (15 minutes):** Examples from toxicity tests	1. Pesticides, Organophosphates, carbamates, organochlorines, Pesticide analysis in food and water samples (GC-MS, QuEChERS method), Soil washing, bioremediation, incineration methods. Sources: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of*

		Toxicology: Environmental and Industrial Applications (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
11	**Lecture:** Polyaromatic Hydrocarbons (PAHs), Combustion products, carcinogenicity, PAH analysis in air/solid samples (HPLC-FLD, GC-MS), Thermal oxidation, UV/Fenton oxidation **Quick Practice (15 minutes):** Examples from toxicity tests	1. Polyaromatic Hydrocarbons (PAHs), Combustion products, carcinogenicity, PAH analysis in air/solid samples (HPLC-FLD, GC-MS), Thermal oxidation, UV/Fenton oxidation. Sources: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal* (2nd ed.). Wiley
12	**Lecture:** Industrial Solvents and Plastic Additives, Formaldehyde, styrene, phthalates, BPA, FTIR, determination of plastic additives by GC-MS, New Organic Materials and Nanotoxicology, Nanopolymers, carbon nanotubes, graphene, DLS, determination of nanoparticles by TEM/SEM, Filtration, membrane systems, photocatalytic methods **Quick Practice (15 minutes):** Literature analysis of phthalate leaching in plastics **Quiz 2 (15 minutes):** A short exam on the topics covered in weeks 9-11	1. Industrial Solvents and Plastic Additives, Formaldehyde, styrene, phthalates, BPA, FTIR, determination of plastic additives by GC-MS, New Organic Materials and Nanotoxicology, Nanopolymers, carbon nanotubes, graphene, DLS, determination of nanoparticles by TEM/SEM, Filtration, membrane systems, photocatalytic methods. Sources: 1. Klaassen, C. D. (Ed.). (2013). *Casarett and Doull's Toxicology: The Basic Science of Poisons* (8th ed.). McGraw-Hill Education. 2. Hodgson, E. (2010). *A Textbook of Modern Toxicology* (4th ed.). Wiley. 3. Wexler, P., & Hayes, A. W. (2001). *Principles of Toxicology: Environmental and Industrial Applications* (2nd ed.). CRC Press. 4. Williams, P. L., James, R. C., & Roberts, S. M. (2000). *Industrial Toxicology* (2nd ed.). Wiley. 5. Winder, C., & Stacey, N. (2004). *Occupational Toxicology* (2nd ed.). CRC Press. 6. Clayton, G. D., & Clayton, F. E. (Eds.). (1994). *Patty's Industrial Hygiene and Toxicology* (Vols. 1–4, 4th ed.). Wiley-Interscience. 7. Manahan, S. E. (2002). *Toxicological Chemistry and Biochemistry* (3rd ed.). CRC Press. 8. Hutchinson, T. C., & Meema, K. M. (Eds.). (1987). *Environmental Toxicology*. Springer. 9. Derelanko, M. J., & Auletta, C. S. (2014). *Handbook of Toxicology* (3rd ed.). CRC Press. 10. Carson, P. A., & Mumford, C. J. (2002). *Hazardous Chemicals Handbook* (2nd ed.). Butterworth-Heinemann. 11. Williams, P. T. (2005). *Waste Treatment and Disposal*

		(2nd ed.). Wiley
13	**Midterm 2**	Review of all topics covered up to the exam week.
14	**Lecture:** Project Presentations and Evaluations Student projects: Examples of articles on examples in the field	1. Project Presentations and Evaluations.
15	**Lecture:** Project Presentations and Evaluations Student projects: Examples of articles on examples in the field	1. Project Presentations and Evaluations.
16	Final	Review of all topics covered.

ECTS WORKLOAD TABLE

Activities	Number	Duration (Hour)	Total Workload
Course Hours	**13**	**3**	**39**
Laboratory			
Application			
Field Work			
Study Hours Out of Class	**13**	**5**	**65**
Special Course Internship (Work Placement)			
Homework Assignments			
Quizzes/Studio Critics	**2**	**3**	**6**
Project			
Presentations / Seminar	**1**	**7**	**7**
Mid-Terms (Examination Duration + Examination Prep. Duration)	**2**	**6**	**12**
Final (Examination Duration + Examination Prep. Duration)	**1**	**13**	**13**
		Total Workload:	**149**
		Total Workload / 30(h):	**4.97**
		ECTS Credit:	**5**

Ders Öğrenim Çıktısı & Program Çıktısı Matrisi

	DÖÇ-1	DÖÇ-2	DÖÇ-3	DÖÇ-4	DÖÇ-5
PÇ-1 Temel kimyasal kavramları tanımlayıp kimya ile ilgili alanlardaki bilgileri, uygulama araç-gereçlerle destekleyerek bilimsel yaklaşımı ön plana alacak şekilde ileri düzeydeki kuramsal ve uygulamalı bilgileri kazanabileceklerdir. / Define the basic chemical concepts and gain advanced theoretical and practical knowledge in the fields related to chemistry in a way to emphasize the scientific approach by supporting the knowledge with application tools and equipment.	**5**	**5**	**5**	**5**	**5**
PÇ-2 Alanlarında edindikleri ileri düzey teorik ve uygulamalı bilgilerini, kimya ile ilgili alanlardaki problemlerin incelenmesi için deney tasarlayıp çözüm yöntemi geliştirme, uygun analitik yöntemler ve teknikler kullanarak problemleri çözme, verileri toplama, sonuçları analiz etme ve yorumlama için kullanabileceklerdir. /Students will be able to use their advanced theoretical and practical knowledge in the field of chemistry to design experiments and develop solution methods for the investigation of problems in chemistry related fields, solve problems using appropriate analytical methods and techniques, collect data, analyze and interpret results	**5**	**5**	**5**	**5**	**5**
PÇ-3 Alanlarında edindikleri ileri düzey teorik ve uygulamalı bilgileri kullanarak kimya ile ilgili alanlarda karşılaşılan ve öngörülemeyen karmaşık sorunlara, araştırma yöntemlerini kullanarak, yeni stratejik yaklaşımlar geliştirerek ve sorumluluk alarak çözüm üretebileceklerdir. /To be able to solve complex	**-**	**-**	**-**	**-**	**-**

and unforeseen problems encountered in chemistry related fields by using advanced theoretical and practical knowledge in their fields, using research methods, developing new strategic approaches and taking responsibility.					
PÇ-4 Kimya ve ilgili alanlarda bağımsız olarak ve paydaşlarıyla ortaklaşa çalışmalar yürütebilecek ve analitik düşünme yeteneğini kullanabileceklerdir. /Students will be able to conduct studies independently and in collaboration with stakeholders in chemistry and related fields and use analytical thinking skills.	-	-	-	-	-
PÇ-5 Seçtikleri bir veya birden fazla kimya uygulama alanında (Kalite Eğitimi, Farmasötik Ürün, Biyokimyasal Teknolojiler, Polimer Teknolojisi, Gıda Kimyası, Çevre Kimyası vb) uzman statüsü kazanabileceklerdir. /They will be able to gain expert status in one or more chemistry application areas of their choice (Quality Education, Pharmaceutical Products, Biochemical Technologies, Polymer Technology, Food Chemistry, Environmental Chemistry, etc.).	-	-	-	-	-
PÇ-6 Kimya alanında yaygın olarak kullanılan bilgisayar ve yapay zekâ teknolojileri ile en az bir programlama dilini, problemleri çözmek, veri analizi yapmak ve simülasyonlar gerçekleştirmek için etkin biçimde kullanabileceklerdir. /They will be able to effectively use computer and artificial intelligence technologies widely used in the field of chemistry and at least one programming language to solve problems, analyze data and perform simulations.	-	-	-	-	-
PÇ-7 Kimya ve ilgili	**5**	**5**	**5**	**5**	**5**

alanlardaki kariyer fırsatlarını değerlendirerek kişisel ve mesleki gelişim hedeflerini belirleyebilecekler ve bu hedeflere ulaşmak için hayat boyu öğrenme stratejilerini kullanabileceklerdir. /Identify personal and professional development goals by evaluating career opportunities in chemistry and related fields and use lifelong learning strategies to achieve these goals.					
PÇ-8 Bilimsel araştırmalarını ve mesleki faaliyetlerini yürütürken doğabilecek hukuksal sonuçları dikkate alarak mesleki etik ilkeler ile toplumsal ve evrensel değerler doğrultusunda ve sosyal sorumluluk bilinci ve adalet duygusuyla hareket edebileceklerdir. /They will be able to act in line with professional ethical principles and social and universal values and with a sense of social responsibility and justice, taking into account the legal consequences that may arise while conducting scientific research and professional activities.	-	-	-	-	-
PÇ-9 Bireysel ya da takım olarak yürüttükleri çalışmalarda ve projelerde kalite yönetimi ilkelerini uygulayarak süreçleri ve sonuçları kalite standartları çerçevesinde değerlendirebileceklerdir. /They will be able to evaluate processes and results within the framework of quality standards by applying quality management principles to their individual and team projects.	-	-	-	-	-
PÇ-10 Belirli bir kimya ile ilgili konu hakkında literatür taraması yaparak güvenilir bilgi kaynaklarını etkin bir şekilde kullanabileceklerdir. /By conducting a literature review on a specific chemistry-	**5**	**5**	**5**	**5**	**5**

related topic, they will be able to use reliable sources of information effectively.					
PÇ-11 Teorik ve uygulamalı kimya alanında özgün akademik araştırma yürütebileceklerdir. /Conduct original academic research in the field of theoretical and applied chemistry	**4**	**4**	**5**	**4**	**4**
PÇ-12 İleri düzey kimya bilgilerini takip edebilecek, kimya ile ilgili konuları ve araştırmaları kimyasal terminoloji kullanarak Türkçe ve İngilizcede tüm paydaşlara sözlü ve yazılı olarak aktarabileceklerdir. /Students will be able to follow advanced chemistry knowledge, transfer chemistry related topics and researches to all stakeholders orally and in writing in Turkish and English using chemical terminology.	**-**	**-**	**-**	**-**	**-**