

## İndirilme Tarihi

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## MAT452 - INTEGRAL TRANSFORMS AND INTEGRAL EQUATIONS II - Fen Edebiyat Fakültesi - Matematik Bölümü

### General Info

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#### Objectives of the Course

The purpose of this course is to teach the basic concepts, solution methods and applications of integral equations and to enable students to develop solution techniques.

#### Course Contents

Fredholm equations, Volterra integral equations, Applications of integral equations to ordinary differential equations.

#### Recommended or Required Reading

1) Textbook - Kevser Özden Köklü, İntegral Denklemler, Papatya Yayıncılık, 2018. 2) Lecture Notes

#### Planned Learning Activities and Teaching Methods

Teaching Methods: -Lecture Method: Used for the direct transmission of theoretical knowledge. It is particularly effective at the beginning of the course and when introducing new topics. -Question-Answer Method: Used to increase student participation and assess their level of understanding. This method encourages active participation and helps reinforce learning. -Discussion Method: Aims to develop students' critical thinking skills and enables them to evaluate topics from different perspectives. This method encourages deep thinking. Planned Learning Activities: -Weekly Lectures: The designated topics will be covered each week, along with the solution of related example problems. -Assignments: Regular assignments will be given to help students reinforce their understanding and improve their practical skills. -Midterm and Final Exams: Exams will be conducted to assess students' level of knowledge and understanding of the topics.

#### Recommended Optional Programme Components

1- Preliminary Knowledge and Preparation: Students are advised to have a solid foundation in differential equations and integral calculus before starting this course. This will help them better understand the course content. 2- Regular Study: Due to the theoretical nature of the course, it is important to review topics regularly and come to weekly lessons prepared. 3- Utilizing Additional Resources: In addition to the course textbook, reviewing supplementary materials on integral equations and transformations can contribute to understanding the topics from different perspectives. 4- Practice and Problem Solving: To reinforce theoretical knowledge, additional exercises and problem-solving activities are recommended. In particular, practicing solutions for different integral equations will help students grasp the subject more effectively. 5- Taking Advantage of Office Hours: Students are encouraged to utilize the instructor's office hours to clarify any unclear topics or questions. These recommendations will help students gain a deeper understanding of the course content and enhance their academic success.

#### Instructor's Assistants

There are no teaching assistants for this course.

#### Presentation Of Course

This course is conducted through face-to-face education. Teaching methods such as verbal lectures, discussions, and question-and-answer sessions are used in the course.

#### Dersi Veren Öğretim Elemanları

Dr. Öğr. Üyesi Sure Köme

### Program Outcomes

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1. Can convert differential equations to integral equations and integral equations to differential equations.
2. Can obtain the solutions of some integral equations.
3. Can recognize Fredholm integral equations.
4. Can recognize Volterra integral equations.

Order	PreparationInfo	Laboratory TeachingMethods	Theoretical	Practise
1	Before coming to class, you should study pages 13-17 of the textbook (Ders Kitabı - Kevser Özden Köklü, İntegral Denklemler, Papatya Yayıncılık, 2018).	Oral expression, discussion, question-answer	Basic informations about the integral equations	
2	Before coming to class, you should study pages 17-22 of the textbook (Ders Kitabı - Kevser Özden Köklü, İntegral Denklemler, Papatya Yayıncılık, 2018).	Oral expression, discussion, question-answer	Solution of integral equations	
3	Before coming to class, you should study pages 24-33 of the source added as a textbook (Ders Kitabı - Kevser Özden Köklü, İntegral Denklemler, Papatya Yayıncılık, 2018).	Oral expression, discussion, question-answer	Transformation of Linear Differential Equations into Volterra Integral Equations	
4	Before coming to class, you should study pages 33-36 of the source added as a textbook (Ders Kitabı - Kevser Özden Köklü, İntegral Denklemler, Papatya Yayıncılık, 2018).	Oral expression, discussion, question-answer	Transformation of the Volterra integral equation into a linear differential equation	
5	Before coming to class, you should study pages 41-44 of the source added as a textbook ((Ders Kitabı - Kevser Özden Köklü, İntegral Denklemler, Papatya Yayıncılık, 2018).	Oral expression, discussion, question-answer	Introduction to Fredholm Integral Equations	
6	Before coming to class, you should study pages 44-56 of the source added as a textbook (Ders Kitabı - Kevser Özden Köklü, İntegral Denklemler, Papatya Yayıncılık, 2018).	Oral expression, discussion, question-answer	Degenerate kernel Fredholm integral equations	
7	Before coming to class, you should study pages 56-58 of the source added as a textbook (Ders Kitabı - Kevser Özden Köklü, İntegral Denklemler, Papatya Yayıncılık, 2018).	Oral expression, discussion, question-answer	Hammerstein-type integral equations	
8				mid-term exam
9	Before coming to class, you should study pages 58-68 of the textbook (Ders Kitabı - Kevser Özden Köklü, İntegral Denklemler, Papatya Yayıncılık, 2018).	Oral expression, discussion, question-answer	Eigenvalues and Eigenfunctions of Fredholm Integral Equations	
10	Before coming to class, you should study pages 82-84 of the textbook (Ders Kitabı - Kevser Özden Köklü, İntegral Denklemler, Papatya Yayıncılık, 2018).	Oral expression, discussion, question-answer	The relationship between the kernel and the resolvent	
11	Before coming to class, you should study pages 85-90 of the textbook (Ders Kitabı - Kevser Özden Köklü, İntegral Denklemler, Papatya Yayıncılık, 2018).	Oral expression, discussion, question-answer	Iterative kernels	
12	Before coming to class, you should study pages 91-97 of the textbook (Ders Kitabı - Kevser Özden Köklü, İntegral Denklemler, Papatya Yayıncılık, 2018).	Oral expression, discussion, question-answer	Successive approximation method for solving Fredholm integral equations	
13	Before coming to class, you should study pages 203-204 of the textbook (Ders Kitabı - Kevser Özden Köklü, İntegral Denklemler, Papatya Yayıncılık, 2018).	Oral expression, discussion, question-answer	Introduction to Volterra Integral Equations	
14	Before coming to class, you should study pages 204-213 of the textbook (Ders Kitabı - Kevser Özden Köklü, İntegral Denklemler, Papatya Yayıncılık, 2018).	Oral expression, discussion, question-answer	Solving Volterra integral equations with the help of the resolvent	
15	Before coming to class, you should study pages 234-239 of the textbook (Ders Kitabı - Kevser Özden Köklü, İntegral Denklemler, Papatya Yayıncılık, 2018).	Oral expression, discussion, question-answer	Successive approximation method for solving Volterra integral equations	

## Workload

Activities	Number	PLEASE SELECT TWO DISTINCT LANGUAGES
Derse Katılım	14	4,00
Vize	1	2,00
Final	1	2,00
Ara Sınav Hazırlık	2	10,00
Final Sınavı Hazırlık	2	15,00
Ders Öncesi Bireysel Çalışma	14	5,00

## Assesments

Activities	Weight (%)
Ara Sınav	40,00
Final	60,00

## Matematik Bölümü / MATEMATİK X Learning Outcome Relation

	P.O. 1	P.O. 2	P.O. 3	P.O. 4	P.O. 5	P.O. 6	P.O. 7	P.O. 8	P.O. 9	P.O. 10	P.O. 11
L.O. 1	5	5	5		5						
L.O. 2	5	5	5		5						
L.O. 3	5	5	5		5						
L.O. 4	5	5	5		5						

## Table :

- P.O. 1 :** Matematiğin temel alanlarından Analiz, Geometri ve Cebirin temel kavramlarını bilimsel yöntem ve teknikler yardımıyla tanımlar.
- P.O. 2 :** Matematiksel verileri yorumlar, çözümler, güvenilirliğini ve geçerliliğini değerlendirir.
- P.O. 3 :** Günlük hayattaki bazı problemlerin Matematiksel modellerini tanımlar, eleştirel bir açı ile değerlendirir, teorik ve uygulamalı bilgilerle analiz eder.
- P.O. 4 :** Öğrenme süreçlerinde disiplinler arası yaklaşımı analitik olarak kullanır.
- P.O. 5 :** Matematik alanındaki bir konuya uygun materyal geliştirir; bilgi ve tecrübe kazanımlarını farklı yöntemlerle kullanır.
- P.O. 6 :** Kendini bir birey olarak tanıır; yaratıcı ve güçlü yönlerini kullanır, kişisel ve kurumsal iletişim ve etkileşim kurar.
- P.O. 7 :** Alanıyla ilgili öğrenme ihtiyaçlarını belirler. Alanının gerektirdiği düzeyde bilgisayar yazılımı ile birlikte bilişim ve iletişim teknolojilerini ileri düzeyde etkileşimli olarak kullanır.
- P.O. 8 :** Yaşam boyu öğrenme ve kalite yönetim süreçlerini öğrenir ve uygular; alanındaki sosyal, kültürel ve sanatsal etkinliklere katılır.
- P.O. 9 :** Toplumsal sorumluluk bilinciyle mesleki proje ve etkinlikler planlar ve uygular.
- P.O. 10 :** Matematik temel alanının gerektirdiği yabancı dili Avrupa Dil Portföyü B1 Genel düzeyinde kullanarak sözlü ve yazılı iletişim kurar.
- P.O. 11 :** Kazanacağı bilgi birikimi ile sorumluluğu altında çalışanların öğrenme gereksinimlerini belirler, lisansüstü eğitimin gereklerini yerine getirir.
- L.O. 1 :** Diferansiyel denklemleri integral denklemlere ve integral denklemleri diferansiyel denklemlere çevirebilir.
- L.O. 2 :** Bazı integral denklemlerin çözümlerini elde edebilir.
- L.O. 3 :** Fredholm integral denklemlerini tanıyabilir.
- L.O. 4 :** Volterra integral denklemlerini tanıır.