MAT331 - PARTIAL DIFFERANTIAL EQUATIONS I - Fen Edebiyat Fakültesi - Matematik Bölümü

General Info

Objectives of the Course

Giving basic information about partial differential equations that the student will need during undergraduate and graduate education. And to figure out how to go about solving problems.

Course Contents

Second order linear equation with constant coefficients, Generalization of equation with constant coefficients, Non-reducible equations, Euler equation, Second order almost linear equations, Reduction to kanoic form, Second order linear equations with variable coefficients, Order reduction of second order linear equation, Wave equation, A fixed string vibration motion of the ends, Solutions of Laplace equations

Recommended or Required Reading

Kısmi Türevli Denklemler-Prof. Dr. Kerim Koca

Planned Learning Activities and Teaching Methods

The course will involve theoretical lectures, example problem-solving sessions, in-class discussions, homework assignments, and project work. Active student participation will be encouraged during lectures to enhance understanding of the topics. Applied problem-solving using software tools (e.g., Mathematica) will also be demonstrated.

Recommended Optional Programme Components

Regular attendance is crucial for successful completion of the course. Students are encouraged to study independently outside class hours to reinforce the material covered. A strong mathematical background, particularly in differential equations and linear algebra, is essential for success in this course.

Instructor's Assistants

There is no instructor's assistants teaching the course.

Presentation Of Course

The course will be delivered face-to-face (in-person instruction). Alongside theoretical content, practical examples will be included during lectures. Students will be encouraged to actively participate. Online materials may be provided as supplementary resources when necessary.

Dersi Veren Öğretim Elemanları

Assoc. Prof. Dr. Mehmet Şenol

Program Outcomes

1. Explain the fundamental concepts and classifications of partial differential equations (PDEs).
2. Interpret lines, surfaces, tangent planes, and their relationships in space.
3. Distinguish between first-order linear and nonlinear PDEs.
4. Apply the Lagrange and Charpit methods to obtain solutions of first-order PDEs.
5. Construct integral surfaces passing through given curves.
6. Analyze the properties of compatible systems.
7. Transform nonlinear equations into standard form and derive their particular solutions.
8. Utilize the learned methods in applications of engineering and physical sciences.

Weekly Contents

Order	PreparationInfo	Laboratory	TeachingMethods	Theoretical	Practise
1	For this course, students are expected to have background knowledge from Analysis I–IV (functions of several variables, derivatives and integrals), Linear Algebra (matrices, determinants, systems of linear equations, eigenvalues and eigenvectors), and Differential Equations (solution methods for first- and second-order equations). Familiarity with analytic geometry concepts such as lines, planes, surfaces, and tangents is also important.		Lecture (Theoretical Course): Basic concepts and vector-matrix definitions in MATLAB are explained in detail with subject explanations. Practical Demonstration: Vector and matrix operations are demonstrated step by step on the MATLAB screen. Computer-Aided Applications: Students practice on their own computers with examples and exercises. Question-Answer: Intermediate questions are used to ensure active participation of students. Problem Solving: Vector/matrix problems are solved in the context of real-life problems or engineering applications. Quiz and Feedback: Instant evaluation is done with short exercises and tests at the end of the subject.	Introduction to partial differential equations, basic concepts	Introduction to partial differential equations, basic concepts

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2	For this course, students are expected to have background knowledge from Analysis I–IV (functions of several variables, derivatives and integrals), Linear Algebra (matrices, determinants, systems of linear equations, eigenvalues and eigenvectors), and Differential Equations (solution methods for first- and second-order equations). Familiarity with analytic geometry concepts such as lines, planes, surfaces, and tangents is also important.		Lecture (Theoretical Course): Basic concepts and vector-matrix definitions in MATLAB are explained in detail with subject explanations. Practical Demonstration: Vector and matrix operations are demonstrated step by step on the MATLAB screen. Computer-Aided Applications: Students practice on their own computers with examples and exercises. Question-Answer: Intermediate questions are used to ensure active participation of students. Problem Solving: Vector/matrix problems are solved in the context of real-life problems or engineering applications. Quiz and Feedback: Instant evaluation is done with short exercises and tests at the end of the subject.	Surfaces, lines, intersecting surfaces, angle between two surfaces, normal and tangent surfaces	Surfaces, lines, intersecting surfaces, angle between two surfaces, normal and tangent surfaces
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7	For this course, students are expected to have background knowledge from Analysis I–IV (functions of several variables, derivatives and integrals), Linear Algebra (matrices, determinants, systems of linear equations, eigenvalues and eigenvectors), and Differential Equations (solution methods for first- and second-order equations). Familiarity with analytic geometry concepts such as lines, planes, surfaces, and tangents is also important.		Lecture (Theoretical Course): Basic concepts and vector-matrix definitions in MATLAB are explained in detail with subject explanations. Practical Demonstration: Vector and matrix operations are demonstrated step by step on the MATLAB screen. Computer-Aided Applications: Students practice on their own computers with examples and exercises. Question-Answer: Intermediate questions are used to ensure active participation of students. Problem Solving: Vector/matrix problems are solved in the context of real-life problems or engineering applications. Quiz and Feedback: Instant evaluation is done with short exercises and tests at the end of the subject.	Generalization of the Lagrange auxiliary system	Generalization of the Lagrange auxiliary system
8	For this course, students are expected to have background knowledge from Analysis I–IV (functions of several variables, derivatives and integrals), Linear Algebra (matrices, determinants, systems of linear equations, eigenvalues and eigenvectors), and Differential Equations (solution methods for first- and second-order equations). Familiarity with analytic geometry concepts such as lines, planes, surfaces, and tangents is also important.		Lecture (Theoretical Course): Basic concepts and vector-matrix definitions in MATLAB are explained in detail with subject explanations. Practical Demonstration: Vector and matrix operations are demonstrated step by step on the MATLAB screen. Computer-Aided Applications: Students practice on their own computers with examples and exercises. Question-Answer: Intermediate questions are used to ensure active participation of students. Problem Solving: Vector/matrix problems are solved in the context of real-life problems or engineering applications. Quiz and Feedback: Instant evaluation is done with short exercises and tests at the end of the subject.		
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12	For this course, students are expected to have background knowledge from Analysis I–IV (functions of several variables, derivatives and integrals), Linear Algebra (matrices, determinants, systems of linear equations, eigenvalues and eigenvectors), and Differential Equations (solution methods for first- and second-order equations). Familiarity with analytic geometry concepts such as lines, planes, surfaces, and tangents is also important.		Lecture (Theoretical Course): Basic concepts and vector-matrix definitions in MATLAB are explained in detail with subject explanations. Practical Demonstration: Vector and matrix operations are demonstrated step by step on the MATLAB screen. Computer-Aided Applications: Students practice on their own computers with examples and exercises. Question-Answer: Intermediate questions are used to ensure active participation of students. Problem Solving: Vector/matrix problems are solved in the context of real-life problems or engineering applications. Quiz and Feedback: Instant evaluation is done with short exercises and tests at the end of the subject.	Transformation of nonlinear equations into standard form and their solutions	Application of the Lagrange–Charpit method
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Workload

Activities	Number	PLEASE SELECT TWO DISTINCT LANGUAGES
Derse Katılım	14	4,00
Vize	1	1,00
Ödev	4	3,00
Ders Öncesi Bireysel Çalışma	14	1,00
Ders Sonrası Bireysel Çalışma	14	1,00
Ara Sınav Hazırlık	1	1,00

Assesments

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

	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	3	3	2	2							
L.O. 2	3	3	3	2							
L.O. 3	3	3	2	2							
L.O. 4	3	3	2	3		2					
L.O. 5	3	2	3	2							
L.O. 6	3	3	2	2							
L.O. 7	3	3	3	2							
L.O. 8	2	2	2		2						2

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, güvenirliliğini 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 tanır; 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 : Kısmi diferansiyel denklemlerin (KDD) temel kavramlarını ve sınıflandırmalarını açıklar.

L.O. 2 : Doğrular, yüzeyler, teğet düzlemler ve bunların uzaydaki ilişkilerini yorumlar.

L.O. 3 : Birinci basamaktan lineer ve lineer olmayan KDD'leri ayırt eder.

L.O. 4 : Lagrange ve Charpit yöntemlerini kullanarak birinci basamaktan KDD'lerin çözümlerini elde eder.

L.O. 5 : Verilen eğrilerden geçen integral yüzeylerini kurar.

L.O. 6 : Bağdaşabilir sistemlerin özelliklerini analiz eder.

L.O. 7 : Lineer olmayan denklemleri standart forma dönüştürür ve özel çözümlerini elde eder.

L.O. 8 : Öğrendikleri yöntemleri mühendislik ve fen bilimleri uygulamalarında kullanır.