June 2022

Istanbul Technical University - Faculty of Science and Letters

Freshman and Sophomore Mathematics Courses (Mat103, 103E, 104, 104E, 210, 210E).

The Mathematics Department of ITU provides training to students in their first and second year at the university via two different mathematics courses. The students arrive at ITU having obtained quite high entrance examination grades, so the mathematics courses start directly at the Calculus level (no precalculus courses are offered).

The sequential Calculus course Mat103-104[1] (course language Turkish), and Mat103E-104E (course language English), is taken by over 8,600 freshmen each year. Calculus I covers the calculus of single variable functions and differential and integral calculus with applications. Calculus II covers infinite series, vector calculus, multivariable functions, and multiple integrals. The two-semester Calculus sequence is mandatory for all faculties in the university with the exception of the Faculty of Architecture, which requires only the single variable Calculus I. The Calculus sequence is generally completed in the first year[2] and, for many departments, serves as a prerequisite for other courses.

The Engineering Mathematics course Mat210[3] (course language Turkish), and Mat210E (course language English), is offered to sophomores in both Fall and Spring terms. Most departments prefer that students take this course in the Fall Term[4] to meet their departmental prerequisites. Each year over 3,200 sophomores register for this course. It covers ordinary differential equations including series methods, as well as matrices, systems of linear equations, vector spaces, linear transformations, and matrix representations of linear transformations.

With the increasing complexity of engineering problems, mathematics has become a primary pillar of engineering practice. The fundamental goal of the freshman and sophomore mathematics courses is to help prepare students to enter the world of science and engineering. With the help of these mathematics courses, first and second year students achieve simple mastery of solution techniques, understanding of mathematical ideas and processes, and efficiency in applying their understanding to the formation and analysis of mathematical models of physical phenomena and engineering systems.

The Math Department offers the above courses in parallel sections available at different times throughout the week so that students may register for the section best suiting their schedule regardless of department and program. All students registered in the same course, regardless of section or course language, take the same midterm and final exam on the same day, do the same homework and are evaluated using the same grade distribution. Following the examination, correct answers are posted on the website mathavuz.itu.edu.tr. Student grades are also recorded and posted on this website.

Every semester, a new course coordinator is appointed for each course. The course coordinator is responsible for planning and coordinating parallel delivery of the course and for ensuring standardized assessment. Course faculty members work under the coordinator to prepare and edit new exam and

[1] See Appendix 2 – the course catalog forms
[2] See Appendix 1
[3] See Appendix 2 – the course catalog forms
[4] See Appendix 1

graded-homework questions while maintaining a high standard of quality. Two additional professors operate as coordinators to organize the logistics, and oversee the execution, of all exams of the above courses.

The Department of Mathematics also posts non-graded homework for each course on the website mathavuz.itu.edu.tr. The preparation of homework that serves to guide the students is the responsibility of course coordinators. Non-graded homework is posted for each chapter.

Improvements

Pre-COVID

Starting in Fall term 2017, math courses were changed in line with curricular improvements that were being applied throughout the university:

> In the past we had offered two different sequential Calculus courses: a 5-credit course and a 4-credit course. We now offer one standardized Calculus sequence to all departments. This ensures that students' credits still count in the event that they transfer to a different department.
>
> In the past we had designed the Differential Equations and the Linear Algebra courses to be taken separately. In an approach closer to that which has been gaining popularity globally, we have combined these two courses into one: Engineering Mathematics. Students, as a result, are better able to observe the interaction between the two subjects.

The process of exam grade entry was automated during Spring term, 2017. Exam papers were standardized so that grade entry could be done using an optic reader. This offered the advantage of speed and reduced errors. Starting in the fall of 2017, we began to digitize graded exams using an optic reader during the grade entry process. As a result, faculty members were able to quickly access exam papers digitally, and show them to students, in the event that students raised objections to their grades or had questions. This increased transparency in the grading process and significantly sped up the evaluation of objections.

Starting in the spring of 2018, in an effort to raise the standard of student performance, the department established requirements for students to take the final exam. Before the term began, students were informed that they would need to achieve a 25% grade on their midterm in order to take the final, and that they would need to earn a minimum course grade of 30% to pass the class.

COVID

With the start of the pandemic, the Mathematics Department quickly moved to online education with the rest of the university. This transition was completed easily, due to the fact that digital communication with students had already been largely established, and was automated through the website mathavuz.itu.edu.tr.

Upon going online, we immediately adapted all exams to online platforms using multiple choice questions as the primary method of examination. The use of a multiple-choice format allowed for an increase in the total number of questions and enabled us to evaluate students' knowledge of a greater number of subtopics than was previously possible. In addition to the midterm and final exam, we added two graded homework assignments to the term grade calculation. We also increased the final exam entrance stipulation to a 35% grade and required a 35% semester grade for students to pass the course.

Online education also provided students the opportunity to watch recorded classes asynchronously as all lectures were now recorded and made accessible to students registered for the course.

Post-COVID

During Fall term 2021, classes were conducted in one of two ways. Some classes were hybrid with simultaneous online and face-to-face lectures. Some were done completely online. At this point we resumed face-to-face exams. Our exams continued to be prepared using multiple choice questions.

In an effort to improve grading and evaluation, we increased the number of exam questions from 10 to 20, and the number of graded-homework questions from 5 to 10.

Previously, final exam grades had not been disclosed to students. Starting in the fall of 2021 we endeavored to increase transparency by publicizing these grades. At this point we also increased the grade required to pass to 37%.

APPENDIX 1

MATHEMATICS DEPARTMENT

Mat103 - Mat103E (Mathematics 1)
Mat104 - Mat104E (Mathematics 2)

Mat 210 - Mat210E (Engineering Mathematics)

Faculty	Code	Program Name	1st Semester	2nd Semester	3rd Semester
IN	**INS**	Civil Engineering	103E	104-104E	
	INSE	Civil Engineering (% 100 English)	103E	104E	
	JDF/GEO	Geomatics Engineering	103E	104E	
	GEOE	Geomatics Engineering (% 100 English)	103E	104E	
	CEV	Environmental Engineering	103	104E	
	CEVE	Environmental Engineering (% 100 English)	103E	104E	
MM	**MIM**	Architecture	103E		
	MIME	Architecture(% 100 English)	103E		
	SBP	Urban and Regional Planning	103E		
	SBPE	Urban and Regional Planning (% 100 English)	103E		
	EUT	Industrial Product Design	103E		
	EUTE	Industrial Product Design (% 100 English)	103E		
	ENTE	Industrial Design (%100 English)	103E		
	ICM	Interior Architecture	103E		
	PEM	Landscape Architecture	103E		
	PEME	Landscape Architecture (% 100 English)	103E		
MK	**MAK**	Mechanical Engineering	103	104	
	MAKE	Mechanical Engineering (% 100 English)	103E	104E	
	IML	Manufacturing Engineering	103	104	
	IMLE	Manufacturing Engineering (% 100 English)	103E	104E	
EE	**EHB**	Electronics and Communication Engineering	103E	104E	
	EHBE	Electronics and Communication Engineering (% 100 English)	103E	104E	
	ELK	Electrical Engineering	103E	104E	
	ELKE	Electrical Engineering (% 100 English)	103E	104E	
	KOM	Control and Automation Engineering	103E	104E	
	KOME	Control and Automation Engineering (% 100 English)	103E	104E	

Faculty	Code	Program Name	1st Semester	2nd Semester	3rd Semester
MD	**MAD**	Mining Engineering	103E	104E	210
	JEO	Geological Engineering	103	104	210
	JEF	Geophysical Engineering	103	104	210
	PETE	Petroleum and Natural Gas Engineering (% 100 English)	103E	104E	210E
	CHZ	Mineral Processing Engineering	103	104	210
KM	**KMM**	Chemical Engineering	103	104	210E
	MET	Metallurgical and Materials Engineering	103	104	210E
	METE	Metallurgical and Materials Engineering (% 100 English)	103E	104E	210E
	GID	Food Engineering	103	104	210E
IS	**ISL**	Management Engineering	103	104	210E
	ISLE	Management Engineering (% 100 English)	103E	104E	210E
	END	Industrial Engineering	103	104	
	ENDE	Industrial Engineering (% 100 English)	103E	104E	
	ECNE	Economics (% 100 English)	103E	104E	
GD	**DEN**	Shipbuilding and Ocean Engineering	103	104	210E
FE	**FIZ**	Physics Engineering	103E	104E	
	KIM	Chemistry	103	104	
	BIOE	Molecular Biology & Genetics (% 100 English)	103E	104E	
UU	**UCK**	Aeronautical Engineering	103	104	
	UZBE	Astronautical Engineering (% 100 English)	103E	104E	
	MTO	Meteorological Engineering	103	104	210
TK	**TEKE**	Textile Engineering (% 100 English)	103E	104E	210E
BB	**BLG**	Computer Engineering	103E	104E	210
	BLGE	Computer Engineering (% 100 English)	103E	104E	210E
	YZVE	Artificial Intelligence and Data Engineering (% 100 English)	103E	104E	

APPENDIX 2

İTÜ	DERS PROGRAMI FORMU COURSE SYLLABUS FORM	**Son Güncelleme (Last Update)** 21.02.2022

Dersin Adı: Matematik I	**Course Name:** Mathematics I

Kod (Code)	**Yarıyıl (Semester)**	**Kredi (Local Credits)**	**AKTS Kredi (ECTS Credits)**	**Ders Uygulaması, Saat/Hafta (Course Implementation, Hours/Week)**		
				Ders (Theoretical)	**Uygulama (Tutorial)**	**Laboratuvar (Laboratory)**
MAT 103/E	1, 2	4	6	3	2	0

Bölüm / Program (Department / Program)	Matematik / Tüm Programlar (Mathematics / All Programs)		
Dersin Türü (Course Type)	Zorunlu (Compulsory)	**Dersin Dili (Course Language)**	Türkçe / İngilizce (Turkish / English)
Dersin Ön Koşulları (Course Prerequisites)	Yok (None)		

Dersin Mesleki Bileşene Katkısı, % (Course Category by Content, %)	**Temel Bilim ve Matematik (Basic Sciences and Math)**	**Temel Mühendislik (Engineering Science)**	**Mühendislik / Mimarlık Tasarım (Engineering / Architecture Design)**	**Genel Eğitim (General Education)**
	100	-	-	-

Dersin Tanımı (Course Description)	Tek Değişkenli Fonksiyonlar, Limit ve Süreklilik, Türev, Türevin Uygulamaları, Eğri Çizimi, Asimptotlar, İntegral, İntegral Hesabının Temel Teoremi, Transandan Fonksiyonlar, İntegral Teknikleri, Belirsizlik Şekilleri, L'Hôpital Kuralı, Genelleştirilmiş İntegraller, İntegralin Uygulamaları Functions of a Single Variable, Limits and Continuity, Derivatives, Applications of Derivatives, Sketching Graphs of Functions, Asymptotes, Integration, Fundamental Theorem of Calculus, Transcendental Functions, Techniques of Integration, Indeterminate Forms, L'Hôpital's Rule, Improper Integrals, Applications of Integrals
Dersin Amacı (Course Objectives)	1. Tek değişkenli fonksiyonlarda limit, süreklilik, türev ve integral kavramlarını öğretmek. 2. Türev ve integral kavramlarını uygulamada kullanma becerisi sağlamak. 3. Matematik bilgisini mühendislik problemlerini çözmede kullanabilme becerisi kazandırmak. 1. To provide the concepts of functions, limits, continuity, differentiation and integration. 2. To provide the applications of differentiation and integration. 3. To give an ability to apply knowledge of mathematics on engineering problems.
Dersin Öğrenme Çıktıları (Course Learning Outcomes)	Bu dersi tamamlayan öğrenciler aşağıdaki becerileri elde eder: I. Tek değişkenli fonksiyonlarda limit ve süreklilik kavramlarıı kullanabilir,ve türev kurallarını kullanarak fonksiyonları türetebilir, II. Maksimum minimum problemlerini kurabilir ve optimizasyon problemlerini çözebilir, III. Integral Hesabın Esas Teoremi'ni kullanarak belirli integral hesaplar ve alan hacim, yüzey alanı, uzunluk hesabını belirli integral yardımıyla çözebilir, IV. Transandan Fonksiyonlarla işlem yapma ve integral alma tekniklerini uygulabilir, V. Tek değişkenli fonksiyonlarda limit hesaplamak için L'Hôpital kuralını uygular ve genelleştirilmiş İntegrallerin tabiatını belirler ve yakınsak genelleştirimiş integralleri hesaplayabilir.

Students completing this course will be able to:

I. Compute the limit of various functions, use the concepts of the continuity, use the rules of differentiation to differentiate functions,
II. Set up max-min problems and use differentiation to solve them,
III. Evaluate definite integrals by using the Fundamental Theorem of Calculus and apply integration to compute areas, surface areas ,volumes and arclength,
IV. Work with transcendental functions and evaluate integrals using techniques of integration,
V. Use L'Hôpital's Rule to calculate limits of single functions and determine the convergence of Improper Integrals evaluate convergent Improper Integrals.

Ders Planı

Hafta	Konular	Dersin Öğrenme Çıktıları
1	Başlangıçlar, Limit ve Süreklilik	**I**
2	Limit ve Süreklilik	**I**
3	Türev	**I**
4	Türev	**I**
5	Türevin Uygulamaları	**II**
6	Türevin Uygulamaları	**II**
7	İntegral	**III**
8	Transandan Fonksiyonlar	**IV**
9	L'Hôpital Kuralı	**V**
10	İntegral Teknikleri	**IV**
11	İntegral Teknikleri	**IV**
12	Genelleştirilmiş İntegraller	**V**
13	İntegralin Uygulamaları	**III**
14	İntegralin Uygulamaları	**III**

Course Plan

Week	Topics	Course Learning Outcomes
1	Preliminaries, Limits and Continuity	**I**
2	Limits and Continuity	**I**
3	Derivatives	**I**
4	Derivatives	**I**
5	Applications of Derivatives	**II**
6	Applications of Derivatives	**II**
7	Integration	**III**
8	Transcendental Functions	**IV**
9	L'Hôpital's Rule	**V**
10	Techniques of Integration	**IV**
11	Techniques of Integration	**IV**
12	Improper Integrals	**V**
13	Applications of Integrals	**III**
14	Applications of Integrals	**III**

Dersin Mühendislik Öğrenci Çıktılarıyla İlişkisi

	Programın Mezuna Kazandıracağı Bilgi ve Beceriler (Programa Ait Çıktılar)	Katkı Seviyesi		
		1	2	3
1	Mühendislik, fen ve matematik ilkelerini uygulayarak karmaşık mühendislik problemlerini belirleme, formüle etme ve çözme becerisi.			**X**
2	Küresel, kültürel, sosyal, çevresel ve ekonomik etmenlerle birlikte özel gereksinimleri sağlık, güvenlik ve refahı göz önüne alarak çözüm üreten mühendislik tasarımı uygulama becerisi.	**X**		
3	Farklı dinleyici gruplarıyla etkili iletişim kurabilme becerisi.	**X**		
4	Mühendislik görevlerinde etik ve profesyonel sorumlulukların farkına varma ve mühendislik çözümlerinin küresel, ekonomik, çevresel ve toplumsal bağlamdaki etkilerini göz önünde bulundurarak bilinçli kararlar verme becerisi.	**X**		
5	Üyeleri birlikte liderlik sağlayan, işbirlikçi ve kapsayıcı bir ortam yaratan, hedefler belirleyen, görevleri planlayan ve hedefleri karşılayan bir ekipte etkili bir şekilde çalışma yeteneği becerisi.	**X**		
6	Özgün deney geliştirme, yürütme, verileri analiz etme ve yorumlama ve sonuç çıkarmak için mühendislik yargısını kullanma becerisi.		**X**	
7	Uygun öğrenme stratejileri kullanarak ihtiyaç duyulduğunda yeni bilgi edinme ve uygulama becerisi.			**X**

Ölçek: 1: Az, 2: Kısmi, 3: Tam

Relationship of the Course to Engineering Student Outcomes

	Program Student Outcomes	Level of Contribution		
		1	2	3
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.			**X**
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	**X**		
3	An ability to communicate effectively with a range of audiences.	**X**		
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	**X**		
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	**X**		
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.		**X**	
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.			**X**

Scale: 1: Little, 2: Partial, 3: Full

Tarih (Date)	***Bölüm Onayı (Departmental Approval)***
21.03.2019	Matematik Bölümü (Department of Mathematics)

Ders Kaynakları ve Başarı Değerlendirme Sistemi (Course Materials and Assessment Criteria)

Ders Kitabı (Textbook)	Thomas' Calculus (13th Edition) G. B. Thomas, M. D. Weir J. R. Hass (2014) Pearson.		
Diğer Kaynaklar (Other References)	-		
Ödevler ve Projeler (Homework & Projects)	-		
	-		
Laboratuvar Uygulamaları (Laboratory Work)	-		
	-		
Bilgisayar Kullanımı (Computer Usage)	-		
	-		
Diğer Uygulamalar (Other Activities)	-		
	-		
Başarı Değerlendirme Sistemi (Assessment Criteria)	**Faaliyetler (Activities)**	**Adet (Quantity)**	**Genel Nota Katkı, % (Effects on Grading, %)**
	Yıl İçi Sınavları (Midterm Exams)	1	40
	Kısa Sınavlar (Quizzes)	-	-
	Ödevler (Homework)	2	20
	Projeler (Projects)	-	-
	Dönem Ödevi/Projesi (Term Paper/Project)	-	-
	Laboratuvar Uygulaması (Laboratory Work)	-	-
	Diğer Uygulamalar (Other Activities)	-	-
	Final Sınavı (Final Exam)	1	40
VF almamak için gereken (To avoid VF)	At least 35% (i.e. 21 out of 60) from in-term assessments		

İTÜ	DERS PROGRAMI FORMU COURSE SYLLABUS FORM	**Son Güncelleme (Last Update)** 06.10.2021

Dersin Adı: Matematik II	**Course Name:** Mathematics II

Kod (Code)	**Yarıyıl (Semester)**	**Kredi (Local Credits)**	**AKTS Kredi (ECTS Credits)**	**Ders Uygulaması, Saat/Hafta (Course Implementation, Hours/Week)**		
				Ders (Theoretical)	**Uygulama (Tutorial)**	**Laboratuvar (Laboratory)**
MAT 104/E	2	4	6.5	3	2	0

Bölüm / Program (Department / Program)	Matematik / Tüm Programlar (Mathematics / All Programs)		
Dersin Türü (Course Type)	Zorunlu (Compulsory)	**Dersin Dili (Course Language)**	Türkçe / İngilizce (Turkish / English)
Dersin Ön Koşulları (Course Prerequisites)	MAT101-E / MAT103-E / MAT112-E / MAT187-E MIN DD		

Dersin Mesleki Bileşene Katkısı, % (Course Category by Content, %)	**Temel Bilim ve Matematik (Basic Sciences and Math)**	**Temel Mühendislik (Engineering Science)**	**Mühendislik / Mimarlık Tasarım (Engineering / Architecture Design)**	**Genel Eğitim (General Education)**
	100	-	-	-

Dersin Tanımı (Course Description)	Sonsuz Diziler ve Seriler, Kutupsal Koordinatlar, Uzayda Vektörler, Vektör Değerli Fonksiyonlar, Çok Değişkenli Fonksiyonlar ve Kısmi Türevler, Çok Katlı İntegraller Infinite Sequences and Series, Polar Coordinates, Vectors in Space, Vector-Valued Functions, Multivarible Functions and Partial Derivatives, Multiple Integrals
Dersin Amacı (Course Objectives)	1. Dizilerde, serilerde yakınsaklık kavramlarını ve bunların uygulamalarını öğretmek. 2. Çok değişkenli fonksiyonlarda kısmi türev ve integral kavramlarını kullanma becerisi sağlamak. 3. Matematik bilgisini mühendislik problemlerini çözmede kullanabilme becerisi kazandırmak. 1. To provide the concepts and applications of the convergence of sequences and infinite series . 2. To provide the applications of partial differentiation and multiple integrals. 3. To give an ability to apply knowledge of mathematics on engineering problems.
Dersin Öğrenme Çıktıları (Course Learning Outcomes)	Bu dersi tamamlayan öğrenciler aşağıdaki becerileri elde eder: I. Dizilerin ve serilerin yakınsaklığını; kuvvet serilerinin yakınsaklık yarıçapını bulabilir, II. Bir fonksiyonu Taylor Serisine açabilme ve yapılan hata payını bulabilir, III. Üç boyutlu uzayda vektörlerin, vektörel ve skaler çarpımını hesaplayabilme; doğru, düzlem ve kuadrik yüzey denklemlerini yazabilir, IV. Kutupsal koordinatlarda düzlem bölgelerin alanlarını ve eğrilerin yay uzunluğu hesaplayabilir ve vektör değerli fonksiyonlar için limit, süreklilik, ve integral kavramlarını kullanabilir, V. Çok değişkenli fonksiyonlarda limit, süreklilik kavramlarını kullanabilir ; kısmi türev hesaplayabilir; teğet düzlem, doğrultuya göre türev ve gradiyent bulabilir; ekstremum problemlerini ikinci türev testi ve Lagrange çarpan metodu ile çözebilir, VI. Çok katlı integralleri çözebilir ve alan ve hacim hesabında çok katlı integralleri kullanabilir.

Students completing this course will be able to:

I. Determine the convergence of sequences and series compute the radius of convergence of power series,
II. Represent a known function as a Taylor series; approximate a known function with a Taylor polynomial and determine the error involved,
III. Compute the standard representation of a vector in 3-space, compute the dot product and cross product of vectors; write equations of lines, planes and quadric surfaces in 3-space,
IV. Calculate areas of plane regions and lengths of curves in polar coordinates in one variable functions and the concepts of continuity, differentiation, and integration in vector-valued functions,
V. Understand the multivariable functions, analyze limits, determine continuity, and compute partial derivatives of them; find tangent planes, directional derivatives, gradients; apply the second partials test, and Lagrange multipliers to approximate and solve optimization problems,
VI. Compute multiple integrals and use multiple integrals when calculating area and volume.

Ders Planı

Hafta	Konular	Dersin Öğrenme Çıktıları
1	Kutupsal Koordinatlar	**VI**
2	Uzayda Vektörler	**III**
3	Uzayda Vektörler	**III**
4	Vektör Değerli Fonksiyonlar	**IV**
5	Çok Değişkenli Fonksiyonlar ve Kısmi Türevler	**V**
6	Çok Değişkenli Fonksiyonlar ve Kısmi Türevler	**V**
7	Çok Değişkenli Fonksiyonlar ve Kısmi Türevler	**V**
8	Çok Katlı İntegraller	**VI**
9	Çok Katlı İntegraller	**VI**
10	Sayı Dizileri	**I**
11	Sayı Dizileri	**I**
12	Seriler	**I**
13	Seriler	**II**
14	Seriler	**II**

Course Plan

Week	Topics	Course Learning Outcomes
1	Polar Coordinates	**VI**
2	Vectors in Space	**III**
3	Vectors in Space	**III**
4	Vector Valued Functions	**IV**
5	Multivariable Functions and Partial Derivatives	**V**
6	Multivariable Functions and Partial Derivatives	**V**
7	Multivariable Functions and Partial Derivatives	**V**
8	Multiple Integrals	**VI**
9	Multiple Integrals	**VI**
10	Sequences of Numbers	**I**
11	Sequences of Numbers	**I**
12	Infinite Series	**I**
13	Infinite Series	**II**
14	Infinite Series	**II**

Dersin Mühendislik Öğrenci Çıktılarıyla İlişkisi

	Programın Mezuna Kazandıracağı Bilgi ve Beceriler (Programa Ait Çıktılar)	Katkı Seviyesi		
		1	2	3
1	Mühendislik, fen ve matematik ilkelerini uygulayarak karmaşık mühendislik problemlerini belirleme, formüle etme ve çözme becerisi.			**X**
2	Küresel, kültürel, sosyal, çevresel ve ekonomik etmenlerle birlikte özel gereksinimleri sağlık, güvenlik ve refahı göz önüne alarak çözüm üreten mühendislik tasarımı uygulama becerisi.	**X**		
3	Farklı dinleyici gruplarıyla etkili iletişim kurabilme becerisi.	**X**		
4	Mühendislik görevlerinde etik ve profesyonel sorumlulukların farkına varma ve mühendislik çözümlerinin küresel, ekonomik, çevresel ve toplumsal bağlamdaki etkilerini göz önünde bulundurarak bilinçli kararlar verme becerisi.	**X**		
5	Üyeleri birlikte liderlik sağlayan, işbirlikçi ve kapsayıcı bir ortam yaratan, hedefler belirleyen, görevleri planlayan ve hedefleri karşılayan bir ekipte etkili bir şekilde çalışma yeteneği becerisi.	**X**		
6	Özgün deney geliştirme, yürütme, verileri analiz etme ve yorumlama ve sonuç çıkarmak için mühendislik yargısını kullanma becerisi.		**X**	
7	Uygun öğrenme stratejileri kullanarak ihtiyaç duyulduğunda yeni bilgi edinme ve uygulama becerisi.			**X**

Ölçek: 1: Az, 2: Kısmi, 3: Tam

Relationship of the Course to Engineering Student Outcomes

	Program Student Outcomes	Level of Contribution		
		1	2	3
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.			**X**
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	**X**		
3	An ability to communicate effectively with a range of audiences.	**X**		
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	**X**		
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	**X**		
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.		**X**	
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.			**X**

Scale: 1: Little, 2: Partial, 3: Full

Tarih (Date)	***Bölüm Onayı (Departmental Approval)***
21.03.2019	Matematik Bölümü (Department of Mathematics)

Ders Kaynakları ve Başarı Değerlendirme Sistemi (Course Materials and Assessment Criteria)

Ders Kitabı (Textbook)	Thomas' Calculus (13th Edition), G. B. Thomas, M. D. Weir, J. R. Hass, (2014) Pearson.		
Diğer Kaynaklar (Other References)	-		
Ödevler ve Projeler (Homework & Projects)	-		
	-		
Laboratuvar Uygulamaları (Laboratory Work)	-		
	-		
Bilgisayar Kullanımı (Computer Usage)	-		
	-		
Diğer Uygulamalar (Other Activities)	-		
	-		
Başarı Değerlendirme Sistemi (Assessment Criteria)	**Faaliyetler (Activities)**	**Adet (Quantity)**	**Genel Nota Katkı, % (Effects on Grading, %)**
	Yıl İçi Sınavları (Midterm Exams)	1	40
	Kısa Sınavlar (Quizzes)	-	-
	Ödevler (Homework)	2	20
	Projeler (Projects)	-	-
	Dönem Ödevi/Projesi (Term Paper/Project)	-	-
	Laboratuvar Uygulaması (Laboratory Work)	-	-
	Diğer Uygulamalar (Other Activities)	-	-
	Final Sınavı (Final Exam)	1	40
VF almamak için gereken (To avoid VF)	At least 35% (i.e. 21 out of 60) from in-term assessments		

İTÜ	DERS PROGRAMI FORMU COURSE SYLLABUS FORM	**Son Güncelleme (Last Update)** 06.10.2021

Dersin Adı: Mühendislik Matematiği	**Course Name:** Engineering Mathematics

Kod (Code)	**Yarıyıl (Semester)**	**Kredi (Local Credits)**	**AKTS Kredi (ECTS Credits)**	**Ders Uygulaması, Saat/Hafta (Course Implementation, Hours/Week)**		
				Ders (Theoretical)	**Uygulama (Tutorial)**	**Laboratuvar (Laboratory)**
MAT 210/E	3, 4	4	5.5	4	0	0

Bölüm / Program (Department / Program)	Matematik / Tüm Programlar (Mathematics / All Programs)		
Dersin Türü (Course Type)	Zorunlu (Compulsory)	**Dersin Dili (Course Language)**	Türkçe / İngilizce (Turkish / English)
Dersin Ön Koşulları (Course Prerequisites)	MAT102-E / MAT104-E / MAT287-E min DD		

Dersin Mesleki Bileşene Katkısı, % (Course Category by Content, %)	**Temel Bilim ve Matematik (Basic Sciences and Math)**	**Temel Mühendislik (Engineering Science)**	**Mühendislik / Mimarlık Tasarım (Engineering / Architecture Design)**	**Genel Eğitim (General Education)**
	60	40	-	-

Dersin Tanımı (Course Description)

Matrisler ve Lineer Denklem Sistemleri, Vektör Uzayları, Özdeğerler ve Özvektörler, Birinci Mertebeden Diferansiyel Denklemler, Yüksek Mertebeden Lineer Diferansiyel Denklemler, Laplace Dönüşümleri, Birinci Mertebeden Lineer Diferensiyel Denklem Sistemleri.

Matrices and Systems of Linear Equations, Vector Spaces, Eigenvalues and Eigenvectors, First Order Differential Equations, Higher Order Linear Equations, The Laplace Transform, Systems of First Order Linear Differential Equations.

Dersin Amacı (Course Objectives)

1. Lineer denklem sistemlerinin çözüm yöntemlerini öğretmek, matris ve determinant kavramlarını uygulamada kullanma becerisi sağlamak.
2. Diferansiyel denklemleri anlamak, kurmak, çözmek ve yorumlamak için gerekli olan temel kavramları tanıtmak ve çeşitli tipte diferansiyel denklem çözme teknikleri öğretmek.
3. Matematik bilgilerini mühendislik problemlerine uygulama becerisi kazandırmak.

1. To teach the solution methods of linear equation systems and to provide the ability to use the concepts of matrix and determinant in application.
2. To introduce the basic concepts required to understand, construct, solve and interpret differential equations and to teach methods to solve differential equations of various types.
3. To give an ability to apply knowledge of mathematics in engineering problems.

Dersin Öğrenme Çıktıları (Course Learning Outcomes)

Bu dersi tamamlayan öğrenciler aşağıdaki becerileri elde eder:

I. Lineer denklem sistemlerinin çözümünü bulabilir, matrislerle aritmetik işlemler yapabilir, matrisin tersini bulabilir, matrisin determinantını hesaplayabilir ve Cramer kuralını kullanarak lineer sistemleri çözebilir,
II. Vektör uzayı, taban ve boyut kavramlarının önemini öğrenebilir; matrislerin özdeğerlerini ve özvektörlerini bulabilir,
III. Diferansiyel denklemleri belli özelliklerine göre sınıflandırabilir,
IV. Birinci mertebeden lineer ve belirli tipte lineer olmayan diferansiyel denklemleri çözebilir, çözümleri yorumlama ve lineer denklem çözümleri için varlık ve teklik koşullarını anlayabilir,
V. Yüksek mertebeden sabit katsayılı lineer denklemler için çözüm bulma ve lineer bağımsız çözümlerden tüm çözümleri türetebilir; lineer diferansiyel denklem sistemlerini lineer cebir yöntemleriyle çözebilir; Laplace dönüşümü kullanarak başlangıç değer problemleri çözebilir.

Students completing this course will be able to:

I. Solve the systems of linear equations, provide arithmetic operations with matrices, compute the inverse of matrix, determine the value of determinant of a matrix and use Cramer rule to solve the linear systems,
II. Learn the importance of the concepts of vector space, basis and dimension; evaluate the eigenvalues and the corresponding eigenvectors of the matrix,
III. Classify differential equations according to certain features,
IV. Solve first order linear equations and nonlinear equations of certain types, interpret the solutions and understand the conditions for the existence and uniqueness of solutions for linear differential equations,
V. Solve higher order linear differential equations with constant coefficients and construct all solutions from the linearly independent solutions; solve systems of linear differential equations with methods from linear algebra; solve initial value problems using the Laplace transform.

Ders Planı

Hafta	Konular	Dersin Öğrenme Çıktıları
1	Lineer Denklemler ve Matrisler	**I**
2	Lineer Denklemler ve Matrisler	**I**
3	Vektör Uzayları	**II**
4	Vektör Uzayları	**II**
5	Birinci Mertebeden Diferansiyel Denklemler	**III, IV**
6	Birinci Mertebeden Diferansiyel Denklemler	**IV**
7	Yüksek Mertebeden Diferansiyel Denklemler	**V**
8	Yüksek Mertebeden Diferansiyel Denklemler	**V**
9	Özdeğerler ve Özvektörler	**II**
10	Özdeğerler ve Özvektörler	**II**
11	Lineer Diferensiyel Denklem Sistemleri	**IV, V**
12	Lineer Diferensiyel Denklem Sistemleri	**IV, V**
13	Laplace Dönüşümü	**V**
14	Laplace Dönüşümü	**V**

Course Plan

Week	Topics	Course Learning Outcomes
1	Matrices and Systems of Equations	**I**
2	Matrices and Systems of Equations	**I**
3	Vector Spaces	**II**
4	Vector Spaces	**II**
5	First Order Differential Equations	**III, IV**
6	First Order Differential Equations	**IV**
7	Higher Order Differential Equations	**V**
8	Higher Order Differential Equations	**V**
9	Eigenvalues, Eigenvectors	**II**
10	Eigenvalues, Eigenvectors	**II**
11	Linear Systems of Differential Equations	**IV, V**
12	Linear Systems of Differential Equations	**IV, V**
13	Laplace Transform	**V**
14	Laplace Transform	**V**

Dersin Mühendislik Öğrenci Çıktılarıyla İlişkisi

	Programın Mezuna Kazandıracağı Bilgi ve Beceriler (Programa Ait Çıktılar)	Katkı Seviyesi		
		1	2	3
1	Mühendislik, fen ve matematik ilkelerini uygulayarak karmaşık mühendislik problemlerini belirleme, formüle etme ve çözme becerisi.			**X**
2	Küresel, kültürel, sosyal, çevresel ve ekonomik etmenlerle birlikte özel gereksinimleri sağlık, güvenlik ve refahı göz önüne alarak çözüm üreten mühendislik tasarımı uygulama becerisi.	**X**		
3	Farklı dinleyici gruplarıyla etkili iletişim kurabilme becerisi.	**X**		
4	Mühendislik görevlerinde etik ve profesyonel sorumlulukların farkına varma ve mühendislik çözümlerinin küresel, ekonomik, çevresel ve toplumsal bağlamdaki etkilerini göz önünde bulundurarak bilinçli kararlar verme becerisi.	**X**		
5	Üyeleri birlikte liderlik sağlayan, işbirlikçi ve kapsayıcı bir ortam yaratan, hedefler belirleyen, görevleri planlayan ve hedefleri karşılayan bir ekipte etkili bir şekilde çalışma yeteneği becerisi.	**X**		
6	Özgün deney geliştirme, yürütme, verileri analiz etme ve yorumlama ve sonuç çıkarmak için mühendislik yargısını kullanma becerisi.		**X**	
7	Uygun öğrenme stratejileri kullanarak ihtiyaç duyulduğunda yeni bilgi edinme ve uygulama becerisi.			**X**

Ölçek: 1: Az, 2: Kısmi, 3: Tam

Relationship of the Course to Engineering Student Outcomes

	Program Student Outcomes	Level of Contribution		
		1	2	3
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.			**X**
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	**X**		
3	An ability to communicate effectively with a range of audiences.	**X**		
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	**X**		
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	**X**		
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.		**X**	
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.			**X**

Scale: 1: Little, 2: Partial, 3: Full

Tarih (Date)	***Bölüm Onayı (Departmental Approval)***
01.04.2019	Matematik Bölümü (Department of Mathematics)

Ders Kaynakları ve Başarı Değerlendirme Sistemi (Course Materials and Assessment Criteria)

Ders Kitabı (Textbook)	Differential Equations & Linear Algebra (3rd Edition), C. H. Edwards, D. E. Penney, (2011) Pearson.		
Diğer Kaynaklar (Other References)	-		
Ödevler ve Projeler (Homework & Projects)	-		
	-		
Laboratuvar Uygulamaları (Laboratory Work)	-		
	-		
Bilgisayar Kullanımı (Computer Usage)	-		
	-		
Diğer Uygulamalar (Other Activities)	-		
	-		
Başarı Değerlendirme Sistemi (Assessment Criteria)	**Faaliyetler (Activities)**	**Adet (Quantity)**	**Genel Nota Katkı, % (Effects on Grading, %)**
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	Kısa Sınavlar (Quizzes)	-	-
	Ödevler (Homework)	2	20
	Projeler (Projects)	-	-
	Dönem Ödevi/Projesi (Term Paper/Project)	-	-
	Laboratuvar Uygulaması (Laboratory Work)	-	-
	Diğer Uygulamalar (Other Activities)	-	-
	Final Sınavı (Final Exam)	1	40
VF almamak için gereken (To avoid VF)	At least 35% (i.e. 21 out of 60) from in-term assessments		