Math 2420.701.24S: Differential Equations with Applications

Spring 2024

Course section: Math 2420.001, Tues & Thurs : 8.30 - 9:45am, SOM 1.102
Instructor: Dr. Jigarkumar Patel
Office: FO 2.410E
Office hours: Monday: 11:30am-12:30pm and TR: 12:45pm- 1:30pm
E-mail: jigarkumar.patel@utdallas.edu

Course section: Math 2420.002, Tues & Thurs : 11.30 - 12:45am, SCI 2.215
Instructor: Dr. Oleg Makarenkov
Office: FO 2.610C
Office hours: Tuesday and Thursday 1-2pm
E-mail: makarenkov@utdallas.edu

Course section: Math 2420.003, Tues & Thurs : 2:30 - 3:45pm SCI 2.210
Instructor: Dr. Oleg Makarenkov
Office: FO 2.610C
Office hours: Tuesday and Thursday 1-2pm
E-mail: makarenkov@utdallas.edu

Course section: Math 2420.501, Tues & Thurs : 4:00 - 5:15pm, SCI 2.210
Instructor: Dr. Dmitry Rachinskiy
Office: FO 2.602D
Office hours: Tuesday 3.00-4.00pm, or by appointment
E-mail: dmitry.rachinskiy@utdallas.edu

Problem Sections:

Section	Day	Time	Room	TA's Name	Contact
2420.302	M	10:00 - 11:50am	AD 3.218	Chakraborty, Sayoni	sxc220042
2420.303	M	1:00 - 2:50pm	ECSN 2.120	Tola, Astrit	axt200006
2420.304	M	3:00 - 4:50pm	FO 3.222	Chakraborty, Sayoni	sxc220042
2420.305	M	4:00 - 5:50pm	SLC 1.204	Babu, Ivin	ixb220002
2420.306	M	1:00 - 2:50pm	AD 3.218	Crane, Casey	cmc102120
2420.307	M	3:00 - 4:50pm	AD 3.218	Crane, Casey	cmc102120
2420.308	M	10:00 - 11:50am	SLC 2.203	Babu, Ivin	ixb220002

Students MUST be registered for the exam section: Math 2420.701.

Students MUST be registered for ONE of these problem sections: Math 2420.302, Math 2420.303, Math 2420.304, Math 2420.305, Math 2420.306, Math 2420.307, Math 2420.308

Textbook

William E. Boyce and Richard C. DiPrima, *Elementary differential equations and boundary value problems*, John Wiley & Sons, any edition.

Course description

This is an introductory course to the theory of ordinary differential equations (ODEs). Topics to be covered include: first order differential equations, second order linear equations, Laplace transform techniques, systems of first order linear equations, nonlinear systems, power series solutions.

Student Learning Objectives

1. Students will be able to identify different methods of solving differential equations and apply them to obtain solutions for various classes of differential equations.

2. Students will be able to apply their knowledge of differential equations to construct and analyze models arising in applications in mathematics, physics, engineering, population dynamics.

3. Students will be able to perform quantitative and qualitative analysis of problems described by differential equations.

Assignments, quizzes and exams

Assignments: There will be weekly assignments. Those are for practice, NOT for grade.
Quizzes: There will be a weekly quiz during the problem session organized and marked by the teaching assistant.
Exams: There will be three common examinations. All sections take examinations together. Textbooks, notes, calculators or other electronic devises won't be allowed during examination. The midterm and final examinations have been scheduled as follows:

	Week day	**Time**	**Room**	**Date**
Exam I	Monday	7:00pm-9:00pm	SCI 1.220	2024-02-12
Exam II	Monday	7:00pm-9:00pm	SCI 1.220	2024-03-25
Final Exam	Monday	7:00pm-9:45pm	ECSS 2.412, SLC 2.303	2024-05-06

A particular examination room, either ECSS 2.412 or SLC 2.303, will be assigned to you shortly before the final exams.

Students with **documented time accommodations** may be advised to take the exams on the **same dates** in FO2.610F with their Instructor's approval.

For further info see also UTD Course Book: https://coursebook.utdallas.edu/math2420.701.23f

Grading policy

Weekly Quizzes in Problem Sessions: 35%
Midterm Exam I: 20%
Midterm Exam II: 20%
Final Exam: 25%.

Important Dates

Last day for regular registration: Jan 11
Classes begin: Jan 16
End of late registration and last day to add/swap: Jan 23
Census day; Last day to drop without a "W": Jan 31
No classes, Spring break: Mar 11 – 17
Withdrawal period ends: Apr 3
Last day of classes: May 3
Reading day: May 4
Final exams: May 6 – 10

See also UTD Course Book: https://coursebook.utdallas.edu/math2420.701.24s

Further important dates:
http://www.utdallas.edu/academiccalendar/

Detailed course description

1. Introduction: Some basic examples of models, classification of differential equation, standard forms, initial value problems. Few remarks on applications. First order ordinary differential equations (ODEs): existence and uniqueness results. Higher order ODEs.

2. Separable equations, homogeneous equations: techniques of obtaining solutions. (Review of techniques of integration is recommended).

3. First order linear ODEs and Bernoulli's equation. Exact equations and equations which can be made exact using integrating factors. (Review of gradient vector fields recommended).

4. Second order linear ODEs: general theory, homogeneous and non-homogeneous equations, Wronskian and linear independence of solutions. (Review of linear algebra: linear independence and basis recommended).

5. Reduction of order for second order linear ODEs (homogeneous and non-homogeneous).

6. Second order linear homogeneous ODEs with constant coefficients: characteristic equation, real characteristic roots, complex characteristic roots, repeated root. Remarks about higher order linear ODEs with constant coefficients. (Review of complex numbers and complex exponential function recommended).

7. Second order linear nonhomogeneous ODEs: methods of undetermined coefficients and variation of parameters.

8. Euler equation.

9. Laplace transform: definition and its properties, derivation of table of Laplace transforms. Laplace transforms of discontinue functions and impulse functions. Solving linear nonhomogeneous ODEs (with constant coefficients) using Laplace transforms. Examples. (Review of improper integrals and criteria for their convergence recommended).

10. Second order systems of linear ODEs: Classification of singular points, phase portrait. (Review of linear algebra, eigenvalues and eigenvectors recommended).

11. Introduction to nonlinear systems: Equilibrium solutions, linearization, examples from mechanics, electricity and population dynamics.

12. Review of power series: analytic functions, domains of convergence, tests for convergence, basic analytic functions and their power series. Second order linear ODEs with non-constant coefficients: power series solutions. (Review of calculus related to infinite series recommended).

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus: http://go.utdallas.edu/syllabus-policies

These descriptions and timelines are subject to change at the discretion of the Professor.