NEW YORK CITY COLLEGE OF TECHNOLOGY
The City University of New York

DEPARTMENT:

COURSE: MAT 2680

TITLE: Differential Equations

DESCRIPTION: An introduction to solving ordinary differential equations. Applications to various problems are discussed.

TEXT: William T. French, *Elementary Differential Equations* Free Edition 1.01, December 2013

CREDITS: 3 (3 class hours)

PREREQUISITE: MAT 1575

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Updated Spring 2021

A. Testing Guidelines:
The following exams should be scheduled:
1. Three one-session exams
2. A one session Final Examination.

Course Learning Outcomes	General Education Learning Outcomes	Flexible Core-Scientific World
Be able to identify the type of differential equation and choose the appropriate methods to solve the problem	Be able to use the existing knowledge to choose a proper method to accomplish the problem.	Evaluate evidence and arguments critically or analytically
Be able to solve first order linear and nonlinear equations by implementing knowledge from Calculus	Be able to transfer the knowledge of calculus to solve differential equation problems	Produce well-reasoned written arguments using evidence to support conclusions
Be able to model real world problems using first order differential equations and understand the model prediction	Be able to see the connection to experience	Gather, interpret, and assess information from a variety of sources and points of view. Understand the scientific principles underlying matters of policy or public concern in which science plays a role
Be able to solve second order linear differential equations with various methods	Be able to use the existing knowledge to choose a proper method to accomplish the problem. Complete the mathematical analysis and draw proper conclusion. Understand the limitation of each method.	Produce well-reasoned written arguments using evidence to support conclusions.
Be able to model mechanical or electrical problems using second order differential equations and understand the model prediction	Be able to see the connection to other disciplines	Identify and apply fundamental concepts and methods of mathematics to explore the engineering problems Produce well-reasoned written arguments using evidence to support conclusions.
Be able to solve differential equations using power series	Be able to show integrated communication through completing the mathematical reasoning of the problem	Produce well-reasoned written arguments using evidence to support conclusions
Understand Laplace Transform and be able to solve initial value problems using Laplace Transform	Be able to understand the limitations and implications of the method	
Be able to use numerical method to approximate solution when appropriate	Be able to understand the limitations and implications of the method	Demonstrate how tools of science and mathematics can be used to analyze problems and develop solutions

Course Intended Learning Outcomes/Assessment Methods

Learning Outcomes	Assessment Methods
1. Classify differential equations.	Classroom activities and discussion, homework, exams
2. Solve first and second order ordinary differential equations using various techniques.	Classroom activities and discussion, homework, exams
3. Use numerical methods to approximate solutions, when appropriate.	Take-home exam or project
4. Apply methods of solving differential equations to answer questions about various systems (such as mechanical or electrical)	Classroom activities and discussion, homework, exams

General Education Learning Outcomes/Assessment Methods

Learning Outcomes	Assessment Methods
1. Gather, interpret, evaluate, and apply information discerningly from a variety of sources.	Classroom activities and discussion, homework, exams
2. Understand and employ both quantitative and qualitative analysis to solve problems.	Classroom activities and discussion, homework, exams
3. Employ scientific reasoning and logical thinking.	Classroom activities and discussion, homework, exams
4. Communicate effectively.	Classroom activities and discussion, homework, exams

New York City College of Technology Policy on Academic Integrity

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MAT 2680 Differential Equations **Text**: W.F.Trench, *Elementary Differential Equations,* Free Edition 1.01

Session	Section and Topic	Pages	Homework
1	1.2 First Order Equations [OPTIONAL: 1.3 Direction Fields for First Order Equations]	7-13 16-17	p.14: 1, 2(a-c,e-h), 4(a-f), 5, 6, [optional: p. 14: 9 and p. 21: 1-11]
2	2.1 Linear First Order Equations	30-41	p.41: 1-9 odd, 17-23 odd, 31-37 odd, 38, 40, 42
3	2.2 Separable Equations	45-52	p.52: 2, 3, 6, 12, 17-27 odd, 28, 35, 37
4	2.4 Transformation of Nonlinear Equations into Separable Equations	62-68	p.68: 1-4, 7-11 odd, 15-18, 23-27 odd
5	2.5 Exact Equations	73-79	p.79: 1-21 odd, 29, 30, 33, 34
6-7	4.1 Growth and Decay 4.2 Cooling and Mixing 4.3 Elementary Mechanics	130-137 140-147 151-160	p.138: 1-7 odd, 11, 13, 17 p.148: 1-11 odd, 15 p.160: 3, 5, 7, 10
8	**First Examination**		
9	3.1 Euler's Method	96-106	p.106: 1-7 odd, 11-13, 15-19 odd, 20-22
10	3.2 The Improved Euler Method and Related Methods	109-116	p.116: 1-7 odd, 11-13, 15-19 odd, 20-22
11	3.3 The Runge-Kutta Method	119-124	p.124: 1-7 odd, 11-13, 15-19 odd, 20-22
12	5.1 Homogeneous Linear Equations	194-203	p.203: 1-5
13	5.2 Constant Coefficient Homogeneous Equations	210-217	p.217: 1-17 odd, 18-21
14	5.3 Nonhomogeneous Linear Equations	221-227	p.227: 1-5 odd, 9-13 odd, 16-20 even, 25-29 odd, 33-37 odd
15	5.4 The Method of Undetermined Coefficients I	229-235	p.235: 1-29 odd
16	5.6 Reduction of Order	248-252	p.253: 1-3, 5, 9, 13, 17, 19, 25, 31

17	5.7 Variation of Parameters	255-262	p.262: 1-5, 7, 11, 13, 31, 33, 34
18	**Second Examination**		
19	6.1 Spring Problems I 6.2 Spring Problems II	268-277 279-284	p.277: 1, 3, 7-13 odd, 19, 21 p.288: 3, 4, 7-11 odd, 14-16
20	6.2 Spring Problems II (continued) 6.3 The *RLC* Circuit	284-287 290-295	p.288: 13, 17-20 p.295: 1-10
21	7.1 Review of Power Series 7.2 Series Solutions Near an Ordinary Point I	307-316 320-328	p.317: 1, 11, 13, 15-17 p.329: 1, 3, 8, 11-13, 19-25 odd
22	7.3 Series Solutions Near an Ordinary Point II	335-338	p.338: 1-5 odd, 19-23 odd, 33-37 odd, 41-45 odd
23	7.4 Regular Singular Points Euler Equations	344-346	p.347: 1-12
24	**Third Examination**		
25	8.1 Introduction to the Laplace Transform	394-402	p.403: 1(a,b,d,e), 2(b,c,f,g,h,i), 4, 5, 18
26	8.2 The Inverse Laplace Transform [NOTE: use the table on p.463 of the textbook to do the homework]	405-412	p.412: 1(a,b,d,e), 2(a-e), 3(a-d), 4(a,d,e), 6(a), 7(a), 8(a,d)
27	8.3 Solution of Initial Value Problems [NOTE: use the table on p.463 of the textbook to do the homework]	414-419	p.419: 1-31 odd
28	8.6 Convolutions [NOTE: use the table on p.463 of the textbook to do the homework]	441-445	p.450: 2(a,b,c,i,j,l,n), 3(a-c,e-g)
29	**Review**		
30	**Final Examination**		

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Section and Topic	Homework
1.2 First Order Equations 1.3 Direction Fields for First Order Equations (optional)	
2.1 Linear First Order Equations	
2.2 Separable Equations	
2.4 Transformation of Nonlinear Equations into Separable Equations	
2.5 Exact Equations	
3.1 Euler's Method	
3.2 The Improved Euler Method and Related Methods	
3.3 The Runge-Kutta Method	
4.1 Growth and Decay	
4.2 Cooling and Mixing	
4.3 Elementary Mechanics	
5.1 Homogeneous Linear Equations	
5.2 Constant Coefficient Homogeneous Equations	
5.3 Nonhomogeneous Linear Equations	
5.4 The Method of Undetermined Coefficients I	
5.6 Reduction of Order	
5.7 Variation of Parameters	
6.1 Spring Problems I 6.2 Spring Problems II	
6.2 Spring Problems II (continued) 6.3 The *RLC* Circuit	
7.1 Review of Power Series 7.2 Series Solutions Near an Ordinary Point I	
7.3 Series Solutions Near an Ordinary Point II	

7.4 Regular Singular Points Euler Equations	
8.1 Introduction to the Laplace Transform	
8.2 The Inverse Laplace Transform [NOTE: use the table on p.463 of the textbook to do the homework]	
8.3 Solution of Initial Value Problems [NOTE: use the table on p.463 of the textbook to do the homework]	
8.6 Convolutions [NOTE: use the table on p.463 of the textbook to do the homework]	