MATH240 16

Course Summary

Course : MATH240 **Title :** Differential Equations
Length of Course : 16
Prerequisites : MATH226 **Credit Hours :** 3

Description

Course Description: MATH240 is introduction to differential equations. It is designed to introduce students to the basic concepts and techniques of differential equations. The course covers the standard materials addressed in the first semester of college differential equations to include: first and second order differential equations, Laplace transforms and differential equations with variable coefficients. Problems have been selected to illustrate the applications of these techniques across a wide range of areas of science, technology, and economics. It is essential for engineering, science, and economics. Increasingly, applications in business management and related fields also employ the calculus. Prerequisite: MATH226

Course Scope:

The differential equation is a very powerful tool especially in engineering and science. It shows many tools to solve difficult engineering and science problems in real world. The objective of this first course is to introduce the basic concepts of first order of differential equations and move on to second order differential equations. Once finish with second differential equations, applications with first and second order differential equations will be studied. Towards the end of
semester, Laplace transforms and differential equations with variable coefficients will be covered. The course is organized into several distinct parts. The first part of the course reviews the concepts of differential equations. The second part of the course introduces the concepts of higher order differential equations. This is followed by applications of the differential equations. The next portion concentrates on the Laplace transform and other topics. Practical applications of differential equations are emphasized throughout the course.

Objectives

Course Objectives
After completing the course, the student should be able to accomplish these Course Objectives (CO):

- CO-1. Solve ordinary differential equations using techniques such as reduction of order, method of undetermined coefficients, variation of parameters, power series, and Laplace transforms
- CO-2. Solve elementary applied science and engineering problems.
- CO-3. Compute a solution to linear, separable, exact, and Cauchy-Euler differential equations.

- CO-4. Solve systems of linear differential equations.
- CO-5. Solve linear differential equations of higher-order.
- CO-6. Solve applications of second-order linear differential equations.

Outline

Week 1: Introduction to Differential Equations

Learning Objective(s)

(LO-2)
1.1 Definitions and Terminology

1.2 Initial-Value Problems

1.3 Differential Equations as Mathematical Models

Readings

Chapter 1.1,1.2 & 1.3

Assignment(s)

Introduce yourself classmates

Practice problems
1,2,3, 7, 9, 11, 23, 25, 35

Practice problems
1,3, 7, 11, 15, 17,

Practice problems
1,5, 9, 13, 17

These practice problems do not need to be turned in, but it is highly recommended that you complete and check them to insure your mastery of this first chapter. Questions should be posted

Week 2: First-Order Differential Equations

Learning Objective(s)

(LO-1) (LO-3)
2.1 Solution Curves Without a Solution

2.1.1 Direction Fields

2.1.2 Autonomous First Order DEs

2.2 Separate Variables

2.3 Linear Equations

Readings

Chapter 2.1, 2.2 & 2.3

Assignment(s)

Practice problems 2.1:
1,3, 5, 11, 19, 21, 25

Problems 2.2:
1, 3, 5, 7, 9. 11, 23, 25, 29, 37, 41

Problems 2.3:
1, 3, 5, 7, 9. 11, 15, 19, 23, 25, 29, 33

Turn-In Quiz 1 for a grade. (5 %)

Week 3: First-Order Differential Equations

Learning Objective(s)

(LO-3) (LO-1)
2.4 Exact Equations

2.5 Solutions By Substitutions

2.6 A numerical Method

Readings

Chapter 2.4, 2.5 & 2.6

Assignment(s)

Practice problems 2.4:
1, 3,5, 7, 9, 15, 21, 23, 25, 31

Practice problems 2.5:
1,5,7,11, 15, 19, 21, 23, 29

Practice problems 2.6:
1, 3, 5, 9,

Week 4: Modeling with First-Order Differential Equations

Learning Objective(s)

(LO-2), (LO-4)
3.1 Linear Models

3.2 Nonlinear Models

3.3 Modeling with Systems of First-Order

Readings

Chapter 3.1, 3.2 & 3.3

Assignment(s)

Practice problems 3.1:
1, 3, 5, 9, 11, 15, 19, 21, 27, 29, 39, 45

Practice Problems 3.2:
1, 9, 11, 13

Practice problems 3.3:
1, 5, 9, 13

Turn-In Quiz 2 for a grade (6 %)

Week 5: Higher-Order Differential Equations

Learning Objective(s)

(LO-2)
4.1 Preliminary Theory-Linear Equations

4.1.1 Initial-Value and Boundary-Value Problems

4.1.2 Homogeneous Equations

4.1.3 Non-homogeneous Equations

Readings

Chapter 4.1

Assignment(s)

Practice problems 4.1:
1, 3, 5, 7, 11, 15, 17, 25, 27, 29, 31, 35

Week 6: Higher-Order Differential Equations

Learning Objective(s)

(LO-5)
4.2 Reduction of order

4.3 Homogeneous Linear Equations with Constant Coefficients

4.4 Undetermined Coefficients: Superposition Approach

Readings

Chapter 4.2, 4.3 & 4.4

Assignment(s)

Practice problems 4.2:
1, 3, 5, 9, 11, 13, 17

Practice problems 4.3:
1, 3, 5, 13, 15, 17, 19, 23, 27, 29, 33, 39, 43

Practice problems 4.4
1, 3, 5, 7, 9, 13, 17, 19, 23, 27, 29, 33, 35, 39

Turn-In Quiz 3 for a grade (6 %)

Week 7: Higher-Order Differential Equations

Learning Objective(s)

(LO-1), (LO-3) and (LO-5)
4.5 Undetermined Coefficients: Annihilator Approach

4.6 Variation of Parameters

4.7 Cauchy-Euler Equations

Readings

Chapter 4.5, 4.6 & 4.7

Assignment(s)

Practice problems 4.5:
1, 3, 5, 7, 9, 13, 15, 17, 21, 23, 29, 35, 41, 45, 49, 53, 61, 67

Practice problems 4.6:
1, 3, 5, 11, 17, 21

Practice problems 4.7:
1, 3, 5, 7, 9, 13, 15, 17, 21, 23, 29, 35

Week 8: Higher-Order Differential Equations

Learning Objective(s)

(LO-5)
4.8 Solving Systems of Linear Differential Equations by Elimination

4.9 Non-Linear Differential Equations

Readings

Chapter 4.8 & 4.9

Assignment(s)

Practice problems 4.8:
1, 3, 5, 9, 11, 13,15, 17, 21

Practice problems 4.9:
1, 3, 5, 9, 13

Turn-In Midterm for a grade (30 %)

Week 9: Modeling with Higher-Order Differential Equations

Learning Objective(s)

(LO-1), (LO-2)

5.1 Linear Models: Initial-Value Problem

5.1.1 Spring/Mass Systems: Free Undamped Motion

5.1.2 Spring/Mass Systems: Free damped Motion

5.1.3 Spring/Mass Systems: Driven Motion

Readings

Chapter 5.1

Assignment(s)

Practice problems 5.1:
1, 5, 7, 9, 11, 13, 23, 27, 31, 41

Week 10: Modeling with Higher-Order Differential Equations

Learning Objective(s)

(LO-1), (LO-2)
5.2 Linear Models: Boundary-Value Problems

5.3 Non-Linear Models

Readings

Chapter 5.2 & 5.3

Assignment(s)

Practice problems 5.2:
1, 3, 7, 21, 25, 27

Practice problems 5.3:
1,3,5,7, 9, 11, 17

Turn-In Quiz 4 for a grade (6 %)

Week 11: Series Solutions of Linear Equations

Learning Objective(s)

(LO-1), (LO-2)
6.1 Solutions about Ordinary Points

6.1.1 Review of Power Series

6.1.2 Power Series Solutions

6.2 Solutions About Singular points

Readings

Chapter 6.1 & 6.2

Assignment(s)

Practice problems 6.1:
1, 5, 7, 9, 11, 13, 15, 17, 19, 21, 25, 29,

Practice problems 6.2:
1, 3, 5, 7, 11, 13, 15, 17, 19, 23, 25

Week 12: Series Solutions of Linear Equations

Learning Objective(s)

(LO-1), (LO-2)
6.3 Special Functions

6.3.1 Bessel's Equation

6.3.2 Legendre's Equation

Readings

Chapter 6.3

Assignment(s)

Practice problems 6.3:
1,3,5, 7, 9, 11, 17, 43, 45

Turn-In Quiz 5 for a grade (6 %)

Week 13: Laplace Transform

Learning Objective(s)

(LO-1), (LO-2) ,(LO-4), (LO-5) and (LO-6)
7.1 Definition of the Laplace Transform

7.2 Inverse transforms and Transforms of Derivatives

7.2.1 Inverse Transforms

7.2.2 Transforms of Derivatives

7.3 Operational Properties I

7.3.1 Translation on the s-axis

7.3.2 Translation on the t-axis

Readings

Chapter 7.1, 7.2 & 7.3

Assignment(s)

Practice problems 7.1:
1, 3, 5, 7, 11, 15, 19, 23, 29, 35, 37

Practice problems 7.2:
1,3, 5, 7, 9, 11, 25, 29, 31

Practice problems 7.3:
1, 3, 5, 9, 11, 15, 17, 21, 23, 25, 29, 37, 49, 55, 65, 77

Week 14: Laplace Transform

Learning Objective(s)

(LO-1), (LO-2) ,(LO-4), (LO-5) and (LO-6)
7.4 Operational Properties II

7.4.1 Derivatives of a Transform

7.4.2 Transforms of Integrals

7.4.3 Transform of a periodic Function

7.5 The Dirac Delta Function

7.6 Systems of Linear Differential Equations

Readings

Chapter 7.4, 7.5 & 7.6

Assignment(s)

Practice problems 7.4:
1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 25, 31, 37, 41, 49

Practice problems 7.5:
1, 3, 5, 7, 9

Practice problems 7.6
1, 7, 15

Turn-In Quiz 6 for a grade (6 %)

Week 15: Course review

Learning Objective(s)

Review all course material.

Readings

Review ALL course material to prepare for the final examination.

Assignment(s)

Course review

Week 16:

Learning Objective(s)

Final Examination

Readings

Demonstrate your knowledge of calculus

Assignment(s)

Turn-In Final Exam (09) (30 points)

Evaluation

Staying on task and adhering to the published schedule are typically among the most challenging aspects of completing an academic course successfully. This is especially true for online and part-time non-resident programs. To avoid the pitfall of falling behind, students in this course should complete the assigned reading. Students should also complete the Suggested Practice Problems as set forth in the schedule provided in the Course Outline of this syllabus.

Student grades for the course will be based on active weekly forum entries, submitting six tests one mid-term and one final examination. Students must complete all items to successfully master all skills in this course.

> The Week 1 Introduction Forum: During the first week of class each student must make a post to the Week 1 Introduction Forum. You are to use this Forum to introduce yourself and state your goals and objectives as they relate to our course. You are required to make a post to the Week 1 Introduction Forum in order to complete your enrollment in the course. Your post must be **at least 250 words**, and you must complete it by the end of the first week. This is a university requirement. To make a post to the Week 1 Introduction Forum, click on the Forum topic link, then click Post New Thread. In the title block of the dialog box that appears kindly insert your first and last name; compose your post in the message box; and then click Post Message.
>
> Besides completing your enrollment in the course, the Week 1 Introduction Forum is designed to 1) build peer-to-peer relationships by introducing oneself and one's background to the class; 2) to articulate individual student learning goals and/or expectations for the class. Therefore, in your introduction you may wish to touch upon the following:
>
> 1. Who you are and how you would like to be addressed.
> 2. Your academic major or program of study.
> 3. Your current status in your program of study.
> 4. Your academic goals including why you are taking this course and what you hope to achieve by completing it.
> 5. Other information about yourself that you would like to share and might help others know you better.

Weekly Forums: **These Forums are required, not optional!** The weekly discussion forum is for students to post their questions on course content for that week. This forum should not be used to discuss specific quiz questions prior to receiving feedback from the instructor (after the quiz is graded). If there is a question on a specific quiz question, find a similar problem in the book and ask a question on that problem or concept. Asking specific questions on quiz questions creates an unfair advantage and defeats the purpose of the assessment tool.

Quizzes: There will be six quizzes during the course, the first worth 5% the rest worth 6% each. Each quiz will cover one or more chapters in the book used in this course. The quizzes will be open book open notes.

Mid Term Exam: The Mid Term Exam will be taken during Week 8. The exam will cover Chapters 1 thru 4. It is an open book, open note exam. It will be administered similar to the quizzes without a proctor. Students

must complete the Mid Term Exam by the end of Week 8.

Final Exam: The final exam will be taken during the last week of the semester and is worth 30 points; it will cover all materials covered from Week 1 through Week 14 with emphasis on the material covered after the mid-term exam. It will be a two-hour, online exam. It will be an open book and open notes exam; calculators and computers are permitted for use.

There is no extra credit or redo's allowed on work once submitted, and no extra credit or make- up assignments.

Students' final grades will be posted as soon as the instructor receives and evaluates the final exam. Official grades will continue to be issued by the University on the grade report form. Professors have 7 days from the end of the semester to submit their grades to the University.

Please see the Student Handbook to reference the University's grading scale.

The points earned on the graded course assignments will determine the course grade. The final grade in the course will be based on total points. Grades will be assigned based on the following term composite scores:

Grading:

Name	Grade %
Forums and Homework	23.00 %
Honor Pledge	0.96 %
Introductory Post	0.96 %
Week 2	1.44 %
Week 3	1.44 %
Week 4	1.44 %
Week 5	1.44 %
Week 6	1.44 %
Week 7	1.44 %
Week 8	1.44 %
Week 9	1.44 %
Week 10	1.44 %
Week 11	1.44 %
Week 12	1.44 %
Week 13	1.44 %
Week 14	1.44 %
Week 15	1.44 %
Week 16	0.96 %
Quizzes and Projects	42.00 %
Project 1	6.00 %
Project 2	6.00 %
Quiz 1	6.00 %
Quiz 2	6.00 %
Quiz 3	6.00 %
Quiz 4	6.00 %
Quiz 5	6.00 %
Exams	35.00 %
Midterm	14.00 %
Final Exam	21.00 %

Materials

Book Title: A First Course in Differential Equations with Modeling Applications, 11th Ed. - The VitalSource eBook will be provided through the APUS Bookstore.

Author: Dennis G. Zill

Publication Info: Cengage

ISBN: 9781305965720

Book Title: You must validate your cart to get access to your VitalSource e-book(s). If needed, instructions are available here - http://apus.libguides.com/bookstore/undergraduate

Author: N/A

Publication Info: N/A

ISBN: N/A

Additional Resources: You will need a calculator to successfully complete this course. The calculator should include a memory and special functions keys. At your discretion, you may use a scientific or graphing calculator or the calculator on your computer that is capable of performing these functions. There are graphing aides available and they will be mentioned again within the classroom. You may use these for all graded assignments and examinations during the course. A preferred graphing calculator is Microsoft Mathematics 4.0. It is a free graphing calculator provided by Microsoft. Students may download the software by clicking on the following link; Microsoft Mathematics. Concepts using Microsoft Excel will also be explained. Students may make use of the above for all graded assignments during the course.

Tutorials: Additional online help is available through the University. Please go to the web page at http://www.apus.edu/media/mathWV/index.htm to view the tutorials for this class. These tutorials include 4-6 minute vignettes on the course topics and are focused on the weekly learning objectives for Calculus I. Students may access these videos from the links in the Course Outline above by clicking on *Cntrl+Click* on the link.

Websites: In addition to the required course texts the following domain Websites are useful. Please abide by the university's academic policy on academic honesty when using Internet sources as well. Note Web site addresses are subject to change.

Site Name	Website URL/Address
Microsoft Mathematics	Microsoft Mathematics
Kahn Academy	https://www.khanacademy.org/math/differential-equations/first-order-differential-equations
Interactive Differential Equations	http://www.aw-bc.com/ide/idefiles/navigation/toolindexes/1.htm
Patrick JMT	http://patrickjmt.com/topic/differential-equations/

Course Guidelines

Citation and Reference Style

- Attention Please: Students will follow the APA Format as the sole citation and reference style used in written work submitted as part of coursework to the University. Assignments completed in a narrative essay or composition format must follow the citation style cited in the APA Format.

Tutoring

- Tutor.com offers online homework help and learning resources by connecting students to certified tutors for one-on-one help. AMU and APU students are eligible for 10 free hours* of tutoring provided by APUS. Tutors are available 24/7 unless otherwise noted. Tutor.com also has a SkillCenter Resource Library offering educational resources, worksheets, videos, websites and career help. Accessing these resources does not count against tutoring hours and is also available 24/7. Please visit the APUS Library and search for 'Tutor' to create an account.

Late Assignments

- Students are expected to submit classroom assignments by the posted due date and to complete the course according to the published class schedule. The due date for each assignment is listed under each Assignment.
- Generally speaking, late work may result in a deduction up to 15% of the grade for each day late, not to exceed 5 days.
- As a working adult I know your time is limited and often out of your control. Faculty may be more flexible if they know ahead of time of any potential late assignments.

Turn It In

- Faculty may require assignments be submitted to Turnitin.com. Turnitin.com will analyze a paper and report instances of potential plagiarism for the student to edit before submitting it for a grade. In some cases professors may require students to use Turnitin.com. This is automatically processed through the Assignments area of the course.

Academic Dishonesty

- Academic Dishonesty incorporates more than plagiarism, which is using the work of others without citation. Academic dishonesty includes any use of content purchased or retrieved from web services such as CourseHero.com. Additionally, allowing your work to be placed on such web services is academic dishonesty, as it is enabling the dishonesty of others. The copy and pasting of content from any web page, without citation as a direct quote, is academic dishonesty. When in doubt, do not copy/paste, and always cite.

Submission Guidelines

- Some assignments may have very specific requirements for formatting (such as font, margins, etc) and submission file type (such as .docx, .pdf, etc) See the assignment instructions for details. In general, standard file types such as those associated with Microsoft Office are preferred, unless otherwise specified.

Disclaimer Statement

- Course content may vary from the outline to meet the needs of this particular group.

Communicating on the Forum

- Forums are the heart of the interaction in this course. The more engaged and lively the exchanges, the more interesting and fun the course will be. Only substantive comments will receive credit. Although there is a final posting time after which the instructor will grade comments, it is not sufficient to wait until the last day to contribute your comments/questions on the forum. The purpose of the forums is to actively participate in an on-going discussion about the assigned content.

- “Substantive” means comments that contribute something new and hopefully important to the discussion. Thus a message that simply says “I agree” is not substantive. A substantive comment contributes a new idea or perspective, a good follow-up question to a point made, offers a response to a question, provides an example or illustration of a key point, points out an inconsistency in an argument, etc.
- As a class, if we run into conflicting view points, we must respect each individual's own opinion. Hateful and hurtful comments towards other individuals, students, groups, peoples, and/or societies will not be tolerated.

University Policies

Student Handbook

- Drop/Withdrawal policy
- Extension Requests
- Academic Probation
- Appeals
- Disability Accommodations

The mission of American Public University System is to provide high quality higher education with emphasis on educating the nation’s military and public service communities by offering respected, relevant, accessible, affordable, and student-focused online programs that prepare students for service and leadership in a diverse, global society.