



Purpose: It is the intention of this Administrative-Master Syllabus to provide a general description of the course, outline the required elements of the course and to lay the foundation for course assessment for the improvement of student learning, as specified by the faculty of Wharton County Junior College, regardless of who teaches the course, the timeframe by which it is instructed, or the instructional method by which the course is delivered. It is not intended to restrict the manner by which an individual faculty member teaches the course but to be an administrative tool to aid in the improvement of instruction.

Course Title – Differential Equations

Course Prefix and Number – MATH 2320

Department - MATH

Division – Math and Science

Course Type: (check one)

- Academic General Education Course (from ACGM – but not in WCJC Core)
- Academic WCJC Core Course
- WECM course (This course is a Special Topics or Unique Needs Course: Y or N)

Semester Credit Hours #: Lecture hours #: Lab/other hours # **3:3:0**

Equated Pay hours for course - 3

Course Catalog Description – Ordinary differential equations, including linear equations, systems of equations, equations with variable coefficients, existence and uniqueness of solutions, series solutions, singular points, transform methods, and boundary value problems; application of differential equations to real-world problems.

Prerequisites/Co-requisites – TSI satisfied in math, MATH 2414--Calculus II

Type: ACAD

List Lab/ Other Hours
Lab Hours 0
Clinical Hours 0
Practicum Hours 0
Other (list) 0

Prepared by Dale Neaderhouser

Date 8-24-13

Reviewed by department head Dale Neaderhouser

Date 8-24-13

Accuracy verified by Division Chair Kevin Dees

Date 8-24-13

Approved by Dean of or Vice President of Instruction *gghunt*

Date 8-24-13

I. Topical Outline – Each offering of this course must include the following topics (be sure to include information regarding lab, practicum, and clinical or other non-lecture instruction):

A. Definitions, Elimination of Arbitrary Constants (2 Lessons – Chapter1)

1. Parameters
2. Families of Curves

B. Equations of Order One (5 Lessons – Chapter2)

1. The isoclines of an equation
2. Separation of variables
3. Homogeneous functions
4. Equations with homogeneous coefficients
5. Exact equations
6. The linear equation of order one
7. The general solution of a linear equation

C. Elementary Applications (2 Lessons – Chapter3)

1. Velocity of escape from earth
2. Newton's Law of Cooling
3. Simple Chemical Conversion
4. Orthogonal trajectories

D. Additional Topics on Equations of Order One (5 Lessons – Chapter4)

1. Integrating factors by inspection
2. Determination of integrating factors
3. Simple substitutions
4. Coefficients linear in two variables
5. Solutions of non-elementary integrals

E. Linear Differential Equations (5 Lessons – Chapter5)

1. The general linear equation
2. Linear independence
3. The Wronskian
4. General solution of a homogeneous equation
5. General solution of a nonhomogeneous equation
6. Differential operators
7. Properties of Differential Operators

F. Linear Equations with Constant Coefficients (4 Lessons – Chapter6)

1. The auxiliary equation
 - a. Distinct roots
 - b. Repeated roots
 - c. Imaginary roots

G. Nonhomogeneous Equations: Undetermined Coefficients (5 Lessons – Chapter7)

1. Construction of a homogeneous equation from a specified solution
2. Solution of a nonhomogeneous equation
3. The method of undetermined coefficients
4. Solution by inspection

H. Variation of Parameters (3 Lessons – Chapter8)

1. Reduction of Order
2. The inverse operator

I. Inverse Differential Operators (2 Lessons – Chapter 9)

1. The exponential shift
2. The inverse operator

- J. The Laplace Transform (3 Lessons – Chapter 10)
1. Definition of the Laplace Transform
 2. Transforms of elementary functions
 3. Transforming initial value problems
 4. Transforms procedures

II. Course Learning Outcomes

Upon successful completion of this course, students will:

1. Identify homogeneous equations, homogeneous equations with constant coefficients, and exact and linear differential equations.
2. Solve ordinary differential equations and systems of equations using:
 - a) Direct integration
 - b) Separation of variables
 - c) Reduction of order
 - d) Methods of undetermined coefficients and variation of parameters
 - e) Series solutions
 - f) Operator methods for finding particular solutions
 - g) Laplace transform methods
3. Determine particular solutions to differential equations with given boundary conditions or initial conditions.
4. Analyze real-world problems in fields such as Biology, Chemistry, Economics, Engineering, and Physics, including problems related to population dynamics, mixtures, growth and decay, heating and cooling, electronic circuits, and Newtonian mechanics
5. Being given a relation between two or more variables, come to a differential equation consistent with the original relation.
6. Be able to plot the family of curves represented by an equation with a parameter.
7. Use the method of isoclines to sketch some of the solution curves for equations such as:

$$dy = x^2 + y^2, dx$$
8. Be able to recognize and solve equations whose variables are separable.
9. Be able to write the formal definition of homogeneity as applied to equations.
10. Be able to recognize and solve homogeneous equations.
11. Be able to test an equation for exactness.
12. Demonstrate the ability to solve an exact equation.
13. Be able to give an example of a linear equation of order one.
14. Be able to find the integrating factor and solve a linear equation of order one.
15. Demonstrate the ability to find the general solution of a linear equation.
16. Be able to solve simple problems pertaining to Newton's Law of Cooling, Simple Chemical Conversion, Orthogonal Trajectories and Polar Coordinates.
17. Solve equations that are simple enough to find integrating factors by inspection.
18. Use formal procedures for the determination of integrating factors.
19. Be able to recognize and solve certain differential equations that can be simplified and solved by substitution procedures.
20. Be able to recognize and solve Bernoulli's equation.
21. Solve equations whose coefficients are linear in two variables.
22. Solve equations involving non-elementary integrals.
23. Find the general solution of a nonhomogeneous equation.
24. Demonstrate a thorough knowledge of the fundamental laws of differential operators.
25. Solve linear equations with constant coefficients.
26. Construct a homogeneous equation from a specified solution.
27. Solve differential equations by the method of reduction of order.
28. Solve nonhomogeneous equations by variation of parameters.
29. Use the exponential shift and inverse operators to solve differential equations.

Assessment Methods:

Outcomes assessed by:

- Hour exams
- Final
- Short Answer
- Discussion Board

III. Required Text(s), Optional Text(s) and/or Materials to be Supplied by Student.

A Short Course in Differential Equations, 8th Edition
Earl D. Rainville
Published by Prentice Hall

IV. Suggested Course Maximum - 35

V. List any specific spatial or physical requirements beyond a typical classroom required to teach the course.

Students must have computer access to the WCJC website, their WCJC student email and online accounts. WCJC has open computer labs, with internet access, on all campuses for students to use.

VI. Course Requirements/Grading System – Describe any course specific requirements such as research papers or reading assignments and the generalized grading format for the course

- A. Several 50-Minute Closed-book Examinations
- B. Final Examination
- C. Class Participation
- D. Semester Grade
 - 1. Final Examination approximately 20%
 - 2. Other work approximately 80%

A= 90-100 B= 80-89 C= 70-79 D= 60-69 F= 59 and below

VII. Curriculum Checklist

- **Academic General Education Course** (from ACGM – but not in WCJC Core)
No additional documentation needed
- **Academic WCJC Core Course**
Attach the Core Curriculum Review Forms
 - Critical Thinking
 - Communication
 - Empirical & Quantitative Skills
 - Teamwork
 - Social Responsibility
 - Personal Responsibility
- **WECM Courses**
If needed, revise the Program SCANS Matrix & Competencies Checklist.



Core Curriculum Review Form

Foundational Component Area: **Mathematics**

Course Prefix & Suffix: Math 2320

Core Objective: **Critical Thinking Skills**—to include creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information

Student Learning Outcome supporting core objective:

For each core objective, there must be at least two different methods of assessment.

SLO Status	Student Learning Outcome (SLO)	Learning Activity	Assessment
The SLO is:	Insert SLO (from Administrative Master Syllabi (AMS)) below	Provide a brief name and description of the sample learning activity:	Provide a brief name and description of the sample quiz, exam, rubric, assignment, etc. for assessing the objective:
<input checked="" type="checkbox"/> Existing <input type="checkbox"/> Revised <input type="checkbox"/> New <input checked="" type="checkbox"/> State Mandated	Identify homogeneous equations, homogeneous equations with constant coefficients, and exact and linear differential equations. (AMS SLO #1)	A word problem (application) where the student must identify variables, assemble the correct formulas and solve for the desired result. Including a brief paragraph explaining what was done.	A quiz, test or discussion board artifact showing the student's written answer. Grading for correctness and the rubric for critical thinking will assess this.
<input checked="" type="checkbox"/> Existing <input type="checkbox"/> Revised <input type="checkbox"/> New <input checked="" type="checkbox"/> State Mandated	Solve ordinary differential equations and systems of equations using separation of variables. (AMS SLO #2b)	A written paragraph explaining the steps one takes to find the solution.	A quiz, test or discussion board artifact showing the student's written answer. Grading for correctness and the rubric for critical thinking will assess this.
<input checked="" type="checkbox"/> Existing <input type="checkbox"/> Revised <input type="checkbox"/> New <input checked="" type="checkbox"/> State Mandated	Determine particular solutions to differential equations with given boundary conditions or initial conditions. (AMS SLO #3)	Have the student grade an incorrect problem. The student should write a brief paragraph stating what was done incorrectly and what must be done to correct the solution.	A quiz, test or discussion board artifact showing the student's written answer. Grading for correctness and the rubric for critical thinking will assess this.



Core Curriculum Review Form

Foundational Component Area: **Mathematics**

Course Prefix & Suffix: **Math 2320**

Core Objective: **Communication Skills**—to include effective development, interpretation and expression of ideas through written, oral and visual communication

Student Learning Outcome supporting core objective:

For each core objective, there must be at least two different methods of assessment.

SLO Status	Student Learning Outcome (SLO)	Learning Activity	Assessment
The SLO is:	Insert SLO (from Administrative Master Syllabi (AMS)) below	Provide a brief name and description of the sample learning activity:	Provide a brief name and description of the sample quiz, exam, rubric, assignment, etc. for assessing the objective:
<input checked="" type="checkbox"/> Existing <input type="checkbox"/> Revised <input type="checkbox"/> New <input checked="" type="checkbox"/> State Mandated	Identify homogeneous equations, homogeneous equations with constant coefficients, and exact and linear differential equations. (AMS SLO #1)	A word problem (application) where the student must identify variables, assemble the correct formulas and solve for the desired result. Including a brief paragraph explaining what was done.	A quiz, test or discussion board artifact showing the student's written answer. Grading for correctness and the rubric for communication will assess this.
<input checked="" type="checkbox"/> Existing <input type="checkbox"/> Revised <input type="checkbox"/> New <input checked="" type="checkbox"/> State Mandated	Solve ordinary differential equations and systems of equations using separation of variables. (AMS SLO #2b)	A written paragraph explaining the steps one takes to find the solution.	A quiz, test or discussion board artifact showing the student's written answer. Grading for correctness and the rubric for communication will assess this.
<input checked="" type="checkbox"/> Existing <input type="checkbox"/> Revised <input type="checkbox"/> New <input checked="" type="checkbox"/> State Mandated	Determine particular solutions to differential equations with given boundary conditions or initial conditions. (AMS SLO #3)	Have the student grade an incorrect problem. The student should write a brief paragraph stating what was done incorrectly and what must be done to correct the solution.	A quiz, test or discussion board artifact showing the student's written answer. Grading for correctness and the rubric for communication will assess this.



Core Curriculum Review Form

Foundational Component Area: **Mathematics**

Course Prefix & Suffix: **Math 2320**

Core Objective: **Empirical and Quantitative Skills**—to include the manipulation and analysis of numerical data or observable facts resulting in informed conclusions

Student Learning Outcome supporting core objective:

For each core objective, there must be at least two different methods of assessment.

SLO Status	Student Learning Outcome (SLO)	Learning Activity	Assessment
The SLO is:	Insert SLO (from Administrative Master Syllabi (AMS)) below	Provide a brief name and description of the sample learning activity:	Provide a brief name and description of the sample quiz, exam, rubric, assignment, etc. for assessing the objective:
<input checked="" type="checkbox"/> Existing <input type="checkbox"/> Revised <input type="checkbox"/> New <input checked="" type="checkbox"/> State Mandated	Determine particular solutions to differential equations with given boundary conditions or initial conditions. (AMS SLO #3)	A problem where the student computes the solution of a given boundary value problem to the required significant digits.	A quiz, test or discussion board artifact showing the student's written answer. Grading for correctness and the rubric for EQS will assess this.
<input checked="" type="checkbox"/> Existing <input type="checkbox"/> Revised <input type="checkbox"/> New <input checked="" type="checkbox"/> State Mandated	Analyze real-world problems in fields such as Biology, Chemistry, Economics, Engineering, and Physics, including problems related to population dynamics, mixtures, growth and decay, heating and cooling, electronic circuits, and Newtonian mechanics (AMS SLO #4)	A numerical application problem in differential equations answered to the required significant digits.	A quiz, test or scanned artifact showing the student's written answer. Grading for correctness and the rubric for EQS will assess this.
<input checked="" type="checkbox"/> Existing <input type="checkbox"/> Revised <input type="checkbox"/> New <input checked="" type="checkbox"/> State Mandated	Determine particular solutions to differential equations with given boundary conditions or initial conditions. (AMS SLO #3)	Have the student grade an incorrect problem and show the correct work to the required significant digits.	A quiz, test or discussion board artifact showing the student's written answer. Grading for correctness and the rubric for EQS will assess this.

Department Head: Dale Neaderhouser

Date: 8-24-13

WCJC Core Curriculum Review Form-Mathematics (April 2013)

(Modified from Collin College)