PELLISSIPPI STATE TECHNICAL COMMUNITY COLLEGE
MASTER SYLLABUS

DIFFERENTIAL EQUATIONS
MATH 2120

Class Hours: 3.0 Credit Hours: 3.0
Laboratory Hours: 0.0 Date Revised: Fall 02

Catalog Course Description:

A first course in differential equations emphasizing solution techniques. Includes first-order equations and applications, theory of linear equations, basic second-order equations and applications, Laplace transforms, and series solutions.

Entry Level Standards:

A thorough knowledge of algebraic, trigonometric, and beginning through multivariable calculus functions is necessary for entrance to this course.

Prerequisites:

MATH 2110

Textbook(s) and Other Reference Materials Basic to the Course:

Textbook:

Materials:
A graphing calculator

References:

I. Week/Unit/Topic Basis:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Definitions and Terminology, Initial-value Problems, Direction Fields, Euler's Method; 1.1-1.3, 1.5</td>
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<td>2</td>
<td>Phase Portraits, Introduction to motion of a falling body, Separable Equations; 1.4, 2.1-2.2</td>
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<td>3</td>
<td>Linear equations, exact equations; 2.3, 2.4</td>
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<td>4</td>
<td>Substitutions and Transformations; 2.6</td>
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Compartmental analysis, Heating and cooling, Newtonian mechanics; 3.2-3.4

Linear differential operators, fundamental solutions of homogeneous equations; 4.2, 4.3

Reduction of order, homogeneous linear equations with constant coefficients, auxiliary equations with complex roots, superposition and nonhomogeneous equations; 4.4-4.7

Method of undetermined coefficients, variation of parameters; 4.8, 4.9

Interconnected Fluid Tanks, Elimination Method for Systems; 5.1, 5.3

Definition of Laplace transform; 7.2

Properties of the Laplace transform, inverse Laplace transform; 7.3, 7.4

Solving initial value problems, Laplace transforms and special functions; 7.5, 7.6

Power series, analytic functions, and the Taylor series method; 8.2

Power series solutions to linear differential equations; 8.3

Review for Final Exam

Final Exam

II. Course Objectives*:

A. Gain a working knowledge of first- and second-order differential equations and their solutions. I, III, IV

B. Apply the concepts of differential equations to suitable mathematical models. II, III, IV, V

C. Scrutinize solution techniques comparatively (graphical, numerical, matrix, symbolic, transforms, etc.). I, IV, V

*Roman numerals after course objectives reference goals of the university parallel program.

III. Instructional Processes*:

Students will:

1. Employ graphing calculators and/or computer software as tools for the field of study. 
   *Technological Literacy Outcome*

2. Advance their skills in analysis, synthesis, symbol manipulation, graphical conceptualization and technical writing skills using the work and/or projects assigned. 
   *Problem Solving and Decision Making Outcome, Numerical Literacy Outcome, Communication Outcome, Transitional Strategy*

3. Analyze real life problems such as: using first order differential equations to construct compartmental analysis, to investigate Newtonian mechanics models as well as heating and cooling models, and to analyze population growth. In addition, second order differential equations would be used to explain mechanical vibration, spring/pendulum, harmonic motion and forced oscillation models. 
   *Problem Solving and Decision Making Outcome, Numerical Literacy Outcome, Transitional Strategy*
4. Actively engage in student-led discussions and brainstorming sessions about the mathematical/physics based models inherent to the course. Active Learning Strategies, Transitional Strategies

5. Investigate and justify the engineering concepts contained in fields of dynamics and circuit analysis. Problem Solving and Decision Making Outcome, Numerical Literacy Outcome, Transitional Strategy

*Strategies and outcomes listed after instructional processes reference Pellissippi State’s goals for strengthening general education knowledge and skills, connecting coursework to experiences beyond the classroom, and encouraging students to take active and responsible roles in the educational process.

IV. Expectations for Student Performance*:

Upon successful completion of this course, the student should be able to:

1. Solve "separable", "exact", "integrating factor" and "Bernoulli" first order differential equations symbolically. A

2. Apply first order differential equations solution techniques to mathematical models (including: population, heating/cooling, compartmental analysis, Newtonian mechanics, terminal velocity, and logistic models). B

3. Define the numerical solutions (Euler's Method) to first order differential equations. A

4. Illustrate familiarity with graphical solutions to first order differential equations using direction fields, phase portraits and stability. A

5. Determine the best method (graphically, numerically, or symbolically) of solving first order differential equations. A

6. Calculate general and particular solutions to second order linear homogeneous and nonhomogeneous equations with constant coefficients (using "auxiliary equations", "undetermined coefficients" and "variation of parameters" techniques). A

7. Apply second order differential equation solution techniques to mathematical models (including compartmental, mechanical vibration, spring and pendulum models) B

8. Analyze the behavior of the second order solutions for ordinary differential equations. A


10. Use Laplace transforms and translation theorems to find differential equation solutions. A

11. Determine series solutions (Taylor and power series) to differential equations. A

12. Analyze the behavior of the solutions for ordinary differential equations. A

13. Scrutinize solution techniques comparatively (graphical, numerical, matrix, symbolic, transforms, etc.) to gain insight into choosing the best method for the problem at hand. D

*Letters after performance expectations reference the course objectives listed above.

V. Evaluation:

A. Testing Procedures:
Students are evaluated primarily on the basis of tests, computer applications or projects, quizzes, and homework. A minimum of four major tests is recommended.

B. Laboratory Expectations:

N/A

C. Field Work:

N/A

D. Other Evaluation Methods:

N/A

E. Grading Scale:

93% - 100% A
88 - 92 B+
83 - 87 B
78 - 82 C+
70 - 77 C
60 - 69 D
Below 60 F

VI. Policies:

A. Attendance Policy:

Pellissippi State Technical Community College expects students to attend all scheduled instructional activities. As a minimum, students in all courses must be present for at least 75 percent of their scheduled class and laboratory meetings in order to receive credit for the course. Individual departments/programs/disciplines, with the approval of the vice president of Academic and Student Affairs, may have requirements that are more stringent.

B. Academic Dishonesty:

Individual instructors must distribute their policy on academic dishonesty during the first week of class.