COURSE DESCRIPTION:

MAT 250       Fall 2005
Differential Equations  Semester Hours: 3

Instructor:    Dr. J. Bauer
Office:        CS 103
Office Hours:
Telephone:     (402) 375-7334
Email:         jebauer1@wsc.edu
Website:       http://academic.wsc.edu/faculty/jebauer1

Description: First- and second-order methods for
differential equations including: separable, linear,
Laplace transforms, linear systems, and applications.
Qualitative, analytic and numerical techniques will be
considered.

The course is a requirement for the mathematics major, and
is recommended for several science-based majors.

Prerequisite: MAT 240, Calculus II

Class Meeting Time/Place: 1:00-1:50 P.M. MWF, CS 101

COURSE COMPETENCIES: The course will adhere to the
Mathematical Association of America content goals as
reported in Preparing for a New Calculus: Conference
Proceedings. These goals are:

- The emphasis of calculus shall be on the fundamental
  concepts of the subject, not on symbolic manipulation.
- The topics in calculus shall be approached
  symbolically, graphically, numerically and in verbal
  and written form.
- Calculus shall emphasize modeling the real world and
  providing experience with problem solving.
- Appropriate technology shall be available at all times
  for graphing, numerical computations, and symbolic
  manipulations.
- Students are expected to “think” and not just perform
  routine operations. This expectation will be
  reflected in exercises, projects, examinations, and
  written assignments.
COURSE GOALS: It is the course’s intent;

- To provide a sound working base in analysis,
- To provide the student with the basic skills to solve ODEs,
- To increase the student’s ability to apply proper mathematical tools to specific situations,
- To increase the student’s ability to think abstractly,
- To increase the student’s ability to work independently and collaboratively on mathematics,
- To introduce computing technology and apply it to the study of mathematics,
- To create a positive outlook toward mathematics, and
- To provide a realistic view of mathematics involvement in the applied sciences.

INSTRUCTIONAL MATERIALS:


References:


**Recommended Equipment:** Graphing calculator, downloaded version of Octave.

**Resources/Equipment:** Octave (accessible from the MAT Linux-lab)
COURSE OUTLINE:

I. First-Order Linear Differential Equations
   • Initial Value Problems
   • Direction Fields
   • Separable Equations
   • Linear Equations
   • Exact Equations

II. Second-Order Linear Differential Equations
   • Linear Operators
   • Homogeneous Equations
   • Complex Roots (Auxiliary Equations)
   • Superposition and Non-homogeneous Equations
   • Undetermined Coefficients
   • Variation of Parameters
   • Systems of First-Order Equations
   • Numerical Methods for Systems of Second-Order Equations

III. Mathematical Modeling
   • Compartmental Analysis
   • Newton’s Laws of Cooling
   • Newtonian Mechanics
   • Mechanical Vibrations
     • Simple Harmonic Motion
     • Damped Free Vibrations
     • Forced Vibrations
   • Coupled Spring-Mass Systems

IV. Laplace Transforms
   • Definition
   • Properties
   • Inverses
   • Solving IVPs
   • Discontinuous and Periodic Functions
   • Convolution
   • Linear Systems

V. Power Series Solutions
   • Analytic Functions and series Methods
   • Linear Differential Equations
   • Cauchy-Euler Equations
   • Method of Frobenius
COURSE REQUIREMENTS:

A. Student is expected to attend class.
B. Student is to contact instructor prior to planned absences.
C. Student will be given at least 4 unit exams and a comprehensive final.
D. No test shall be made up unless arrangements are made before the test is given.
E. The final must be taken at the time and place scheduled. (________________________________________)
F. Student might be assigned computer labs.
G. No lab assignment will be accepted after its due date without an acceptable excuse.
H. Student is expected to work assignments in the text and be prepared to discuss them during the next scheduled class meeting. Assignments might be collected occasionally.

EVALUATION: Students may be evaluated on the basis of test scores, homework, computer labs and attendance. Homework and computer labs will count no more than 40% of the class grade. Grades will be determined on 10% intervals, i.e. the 90s are an A, the 80s are a B, … Students will be given a comprehensive final. The score received on the final will be incorporated into the student score in the following manner;

- If the score on the final is higher than the student’s class average then the final will count 50%.
- If the score on the final is the same as or no more than 30 points lower than the student’s class average then the final counts 0%.
- If the score on the final is more than 30 points below the student’s class average then the final counts 20%.
- If the student fails to take the final then a 0% will be averaged into the student’s grade at 50%.
WSC STATEMENT OF STUDENT RESPONSIBILITIES:

Wayne State College strives to develop students of a wide range of academic abilities through quality teaching and support. It is our desire to prepare students to accept the privileges, duties, and responsibilities of global citizens; to develop moral and ethical values, to encourage creative ability and develop aesthetic judgments, to encourage the ability to think critically about their world and work; and promote competence in and understanding of fields of knowledge which are required of educated people.

To this end we, the faculty and staff of WSC, have established a standard of student responsibilities in the following statement:

All students will:

Take responsibility for their education. This will include:

- Being knowledgeable of academic requirements and college policies concerning registration, academic standing, payment of tuition and fees, withdrawal and graduation.
- Initiating communication with faculty, advisors and administration regarding questions, concerns and intellectual dialogue.

Cultivate an attitude of integrity both in and out of the class. Integrity is demonstrated by:

- Showing courtesy, dependability, honesty, and respect for instructor expectations concerning attendance, assignments, deadlines and appointments.
- Showing courtesy and respect toward others with diverse points of view in and out of class.
- Displaying a positive work ethic and a genuine interest in welfare of others.
<table>
<thead>
<tr>
<th>WEEK</th>
<th>SECTION</th>
<th>PAGE</th>
<th>PROBLEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.3</td>
<td>22</td>
<td>4, 5, 7</td>
</tr>
<tr>
<td>2</td>
<td>1.4</td>
<td>28</td>
<td>9, 11</td>
</tr>
<tr>
<td></td>
<td>2.2</td>
<td>46</td>
<td>7, 11, 21, 25, 27</td>
</tr>
<tr>
<td>3</td>
<td>2.3</td>
<td>54</td>
<td>8, 13, 19, 21, 33</td>
</tr>
<tr>
<td></td>
<td>2.4</td>
<td>65</td>
<td>13, 17, 21, 25, 29</td>
</tr>
<tr>
<td>4</td>
<td>2.5</td>
<td>71</td>
<td>7, 11</td>
</tr>
<tr>
<td></td>
<td>2.6</td>
<td>78</td>
<td>11, 19, 23, 29, 31</td>
</tr>
<tr>
<td>EXAM I</td>
<td>3.6</td>
<td>132</td>
<td>11, 13, 19, 20, 21</td>
</tr>
<tr>
<td>5</td>
<td>3.7</td>
<td>142</td>
<td>7, 9, 10, 15, 19</td>
</tr>
<tr>
<td>PROJECT</td>
<td>4.2</td>
<td>166</td>
<td>3, 11, 15, 42, 46</td>
</tr>
<tr>
<td></td>
<td>4.3</td>
<td>177</td>
<td>3, 7, 13, 25, 42</td>
</tr>
<tr>
<td>6</td>
<td>4.4</td>
<td>186</td>
<td>11, 16, 33</td>
</tr>
<tr>
<td></td>
<td>4.5</td>
<td>192</td>
<td>3, 7, 19, 27, 42</td>
</tr>
<tr>
<td>7</td>
<td>4.6</td>
<td>197</td>
<td>5, 9, 13, 16, 21</td>
</tr>
<tr>
<td></td>
<td>4.8</td>
<td>219</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>4.9</td>
<td>227</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>5.2</td>
<td>250</td>
<td>5, 7, 13, 19, 25</td>
</tr>
<tr>
<td>9</td>
<td>5.3</td>
<td>261</td>
<td>10, 12, 18, 19, 26</td>
</tr>
<tr>
<td></td>
<td>5.4</td>
<td>274</td>
<td>5, 9, 13, 17, 27</td>
</tr>
<tr>
<td>EXAM II</td>
<td>7.2</td>
<td>359</td>
<td>3, 11, 15, 17, 29</td>
</tr>
<tr>
<td></td>
<td>7.3</td>
<td>365</td>
<td>5, 15, 21, 25, 35</td>
</tr>
<tr>
<td>11</td>
<td>7.4</td>
<td>374</td>
<td>5, 21, 23, 25, 31</td>
</tr>
<tr>
<td></td>
<td>7.5</td>
<td>383</td>
<td>3, 7, 11, 19, 27</td>
</tr>
<tr>
<td>12</td>
<td>7.6</td>
<td>395</td>
<td>5, 11, 29, 37, 40</td>
</tr>
<tr>
<td></td>
<td>7.7</td>
<td>405</td>
<td>3, 4, 22</td>
</tr>
<tr>
<td>13</td>
<td>7.8</td>
<td>412</td>
<td>15, 18</td>
</tr>
<tr>
<td>EXAM III</td>
<td>8.2</td>
<td>438</td>
<td>5, 9, 17, 29, 32</td>
</tr>
<tr>
<td></td>
<td>8.3</td>
<td>449</td>
<td>8, 11, 19, 25, 30</td>
</tr>
<tr>
<td>14</td>
<td>8.4</td>
<td>456</td>
<td>7, 13, 17, 22, 25</td>
</tr>
<tr>
<td>15</td>
<td>8.5</td>
<td>460</td>
<td>3, 7, 15</td>
</tr>
<tr>
<td></td>
<td>8.6</td>
<td>472</td>
<td>3, 13, 23, 29, 33</td>
</tr>
<tr>
<td>EXAM IV</td>
<td>FINAL</td>
<td>Day,</td>
<td>Final December</td>
</tr>
</tbody>
</table>