COURSE DESCRIPTION:
MATHEMATICAL TOOLS FOR
ENGINEERING PROBLEM SOLVING
EGR/MA 265–6C, SPRING 2011

SCHOOL OF ENGINEERING & DEPARTMENT OF MATHEMATICS
UNIVERSITY OF ALABAMA AT BIRMINGHAM

Goals and Contents:

• What is the influence of air resistance on free falling bodies? Or on projectiles?
• How does resonance affect a car traveling along a road that consists of poured concrete sections? What can be done about it?
• How does the charge on the capacitor in an electrical LRC-series circuit change in time?
• When designing a two-stage or three-stage rocket, how should the fuel be distributed over the stages to reach maximal velocity?
• It’s easier to balance a large plate on a fingertip than a small plate. Why?

These are just a few of the questions whose answers require the mathematical tools from the fields of differential equations and multi-variable calculus which will be studied in this course. Thus the goal of this course is two-fold:

• Acquire the mathematical skills in solving differential equations and differentiating and integrating functions of several variables which are most important for applications in the sciences and in engineering. This will include topics such as
  – solving initial value problems for first order ordinary differential equations
  – learning methods to solve homogeneous and inhomogeneous second order ordinary differential equations with constant coefficients
  – knowing calculus concepts for functions of several variables such as partial derivatives, gradients and line integrals
  – the evaluation of double and triple integrals for functions of several variables
• Use the acquired math skills to solve engineering problems and to critically assess the validity of a mathematical solution in applications. Some of the engineering and science problems to be studied are
  – mechanical motion
  – population dynamics
  – vibrations in mechanical and electrical systems
  – center of mass and moments of inertia
  – work done when moving in a force field
Course Instructors:

**Dr. Hassan Moore:** Office HOEN 115C, Phone 934-8410  
E-mail hmoore@uab.edu, Office Hours: Mon and Wed, 9am to 11am, or by appointment

**Dr. Yanni Zeng:** Office CH 496A, Phone 934-2154  
E-mail ynzeng@uab.edu, Office Hours: Mon and Wed, 2pm to 3pm, or by appointment

**Meeting times:** Monday and Wednesday 12:00pm to 1:50pm  
**Meeting location:** BEC 355  
**Prerequisite:** Grade of C or better in MA 126 or equivalent  
**Credits:** 4 semester hours  
**Textbook:** No textbook purchase is required. Lecture notes with the relevant material will be provided electronically in pdf-format via UAB’s Blackboard Learning System. These lecture notes will be incomplete in that they will not contain solutions to examples worked in class. Thus, it is strongly encouraged that you attend all class meetings to take notes.

Suggested reading (if you prefer to have a book for additional reading, but this is not necessary to follow the class):

- Zill, A First Course in Differential Equations (used in MA 252),  
- Stewart, Essential Calculus – Early Transcendentals (used in MA 227).

**Important dates:**

- **First day of classes:** Tuesday, January 4  
- **Last day to add/drop:** January 11  
- **Martin Luther King Birthday Holiday:** Monday, January 17  
- **Engineering Open House:** Monday, February 28 (no class)  
- **Spring Break:** March 14 – March 18  
- **Last day to withdraw:** March 24  
- **Last day of class:** Monday, April 25  
- **In-Class Tests:** Three 50-minute tests will be given. Tentative dates are February 2, March 2 and April 11. At least one week notice will be given for the exact test dates.  
- **Final exam:** Monday, May 2, 10:45 AM to 1:15 PM, BEC 355

**Methods of teaching and learning:**

- Class lecture  
- Project-based learning  
- Active and collaborative learning in class  
- Online homework with instant feedback

**Assessment procedures:**

- Student achievement will be assessed by the following measures:
  - Weekly online homework via the Blackboard Learning System will be given to practice basic math skills. Homework will be due one week after assignment. Online homework contributes 15% to the course average. The two lowest weekly homework grades will be dropped.
- Two project assignments will be given, each devoted to science and engineering applications of the mathematical concepts covered in the course. These assignments will focus on the ability to connect theory and applications and require more conceptional understanding than the online homework assignments. The project assignments contribute $2 \times 10\% = 20\%$ to the course average.
- Three 50-minute in-class tests will be given. The contents of tests will be modeled after problems covered in online homework, problems worked in class and the review problems provided at the end of every chapter of the online class notes. The tests will also check on knowledge of important engineering applications. Each test contributes 12\% to the course average, for a total of 36\%.
- A 150-minute comprehensive final examination will be given on contents modeled after the tests and problems worked in class. The final contributes 29\% to the course average.

Your final grade is determined according to the following table:

<table>
<thead>
<tr>
<th>Course performance</th>
<th>Final Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>88-100</td>
<td>A</td>
</tr>
<tr>
<td>75-87</td>
<td>B</td>
</tr>
<tr>
<td>62-74</td>
<td>C</td>
</tr>
<tr>
<td>50-61</td>
<td>D</td>
</tr>
<tr>
<td>below 50</td>
<td>F</td>
</tr>
</tbody>
</table>

Course policies:
- If a test is missed due to a serious verifiable circumstance or official university business, the test grade will be replaced with the properly re-scaled final exam score. You have to advise the instructors of such circumstances at the earliest possibility.
- Unless there is a serious verifiable circumstance, there will be no make-ups for missed homework assignments other than the two dropped assignments.
- No calculators will be allowed during any of the tests or the final exam.
- No books or notes will be allowed during any of the tests or the final exam.
- Please make sure that you are able to receive e-mail through your Blazer-ID account. Official course announcements may be sent to that address.
- If you wish to request a disability accommodation please contact DSS at 934-4205 or at dss@uab.edu.

How to access the Blackboard Learning System: Online homework problems, the syllabus, the class notes, class announcements, online discussions may all be found at the following:

http://www.uab.edu/academiccourses

Click on the "Students" link if you want to learn more about Blackboard Vista. If you think that you don’t need this, just login with your BlazerId and go to our course named “EGR 265 Math Tools for Engr Prob Solvi - EGR/MA 265-6C Spring 2011”.