Advanced Engineering Math Methods  
(MEEN 5140)  
Fall 2016 (3 credits)

Instructor: Dr. Liping Cai, Phone: 940-369-8720,  
E-mail: liping.cai@unt.edu; DP, Rm #F101T.1;  
Office hours: Mon and Wed 4:00 – 5:00 pm

Class lecture time:  
Mon/Wed/Fri 8:30-9:20 am  
Classrooms:  
Lecture: DP B142

TEXTBOOKS:  

COURSE DESCRIPTION  
This is a graduate course appropriate for students in mechanical and energy engineering. The topics to be covered are: solution of ordinary differential equations by power series methods and special functions, Laplace transform methods, and phase plane methods; solution of the partial differential equations of physics-the heat, and Laplace equations-by separation of variables. Chapters in Textbook 1 to be covered are: Chapters 4, 5, 6, 17, and 18. In addition, the control volume method in numerical methods will be also introduced. Chapters in Textbook 2 to be covered are: Chapters 2 and 3 for the control volume method. The final project will use a numerical method to solve partial differential equations describing an actual research example. The final report needs to be prepared and presented in the classroom.

GRADING:  
90 - 100% (A); 80 - 89% (B); 70 - 79% (C); 60 – 69% (D); Below 60 (F)

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<th>Component</th>
<th>Percentage</th>
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<tr>
<td>Homework</td>
<td>20%</td>
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<tr>
<td>Midterm</td>
<td>35%</td>
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<tr>
<td>Final Project</td>
<td>45%</td>
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<td>Total</td>
<td>100%</td>
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The instructor reserves the right to change this grade distribution at the end of the semester. If any changes occur, the changes will be less stringent that the distribution above.

COURSE REQUIREMENTS:  
1. Students are required to attend lectures.  
2. Homework will be turned in on the due date. NO late homework will be collected.  
3. Makeup examination will not be given, and only be administered under extreme circumstances with a documented university excuse.  
4. The instructor reserve the right to make changes to this syllabus as needed
<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Subject</th>
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| 1    | 08/29 - 09/02 | Review of 1st and 2nd order ODE  
Book1-Ch.4: power series solutions: Review of Power series |
| 2    | 09/05 - 09/09 | Book1-Ch.4: power series solutions: Power series solution to ODE       |
| 3    | 09/12 – 09/16 | Book1-Ch.4: power series solutions: Frobenius Method: case I and case II |
| 4    | 09/19 – 09/23 | Book1-Ch.4: power series solutions: Frobenius Method: case III and Legendre Equation |
| 5    | 09/26 – 09/30 | Book1-Ch.4: power series solutions: Legendre Equation and Bessel Equation |
| 6    | 10/03 – 10/07 | Book1-Ch.5: Laplace transform                                           |
| 7    | 10/10 – 10/14 | Book1-Ch.6: Numerical methods for ODE: Euler Method, R-K Method and Backward Euler Method  
Multiple Steps Method and Higher order ODE |
Midterm Exam (Friday) |
| 9    | 10/24 – 10/28 | Start to prepare final project: determine the topic  
Book1-Ch.18: Diffusion Equation: Introduction, Preliminary Concepts  
Book1-Ch.18: Diffusion Equation: Separation of variables |
| 10   | 10/31 – 11/04 | Book1-Ch.18: Diffusion Equation: Finite Difference Method, Implicit method  
Example for solving a diffusion model |
| 11   | 11/07 – 11/11 | Book2-Ch.2 One dimension control volume method  
Example for solving a partial differential equation using 1-D method |
| 12   | 11/14 – 11/18 | Book2-Ch.2 One dimension control volume method,  
Book2-Ch.3. Two-dimension Control volume method |
| 13   | 11/21 – 11/25 | Book2-Ch.3. Two-dimension Control volume method  
Example for solving a partial differential equation using 2-D method  
Thanks giving |
| 14   | 11/28 – 12/02 | Book2-Ch.3: Cylindrical coordinates problem  
Example for solving Cylindrical coordinates problem  
Final project presentation |
| 15   | 12/05 – 12/08 | Final project presentation |