King Fahd University of Petroleum and Minerals
Department of Mathematical Sciences
SYLLABUS
Semester II: 2005-2006**(052)**
(Dr. M. Sarhan)

Course #: MATH 202
Title: Elements of Differential Equations
Textbook: A First Course in Differential Equations by D.G. Zill, 8th Edition

Week	Date	Sec.	Topics	Homework	(CAS)
1	Feb 12-**16***	1.1	Definition and Terminology	4, 7, 8, 9, 10, 13, 16, 20, 27, 28, 30	**(55)**
		1.2	Initial-Value Problems	2, 12, 20, 22, 27	**--**
2	Feb 18-22	2.1	Solution Curves (*light coverage*)	1, 21, 24	**(5,7)**
		2.2	Separable Variables	8, 14, 20, 22, 23, 27, 45	**(ex 4)**
3	Feb 25-Mar 01	2.3	Linear Equations	5, 13, 16, 18, 30, 37	**(5,9)**
		2.4	Exact Equations	2, 5, 8, 15, 25, 27, 29, 31, 42(a), 43, 44	**--**
4	Mar 04-08	2.5	Solutions by Substitutions	4, 6, 10, 13, 18, 21, 26, 30	**--**
		1.3	Mathematical Models (*reading*): Growth and Decay, Newton's Law of Cooling and Mixtures	*See Sec. # 3.1*	
		3.1	Linear Models	3, 6, 13, 14, 15, 19, 20, 21, 23	**--**
5	Mar 11-15	4.1	Linear Equations: Basic Theory		
		4.1.1	Initial-Value and Boundary-Value Problems	3, 10, 12, 13	**--**
		4.1.2	Homogeneous Equations	15, 21, 23, 28	**--**
6	Mar 18-22	4.1.3	Nonhomogeneous Equations	33, 36, 37(b,e)	**--**
		4.2	Reduction of Order	1, 3, 12, 14, 19	**--**
7	Mar 25-29	4.3	Homogeneous Linear Equations with Constant Coefficients	4, 9, 12, 15, 20, 34, 40, 49, 50, 51	**(57)**
		4.5	Undetermined Coefficients – Annihilator Approach	8, 13, 22, 24, 34, 41, 48, 64, 67, 73	**--**
			Midterm Break: Sat-Sun, April 01-02, 2006		
8	Apr 03-05	4.6	Variation of Parameters	6, 11, 13, 24, 25, 28	**--**
		4.7	Cauchy-Euler Equation (*Both Methods*)	3, 5, 10, 11, 14, 16, 19, 31, 34, 37, 39	**(44)**
9	Apr 08-12	6.1	Solutions About Ordinary Points		
		6.1.1	Review of Power Series	1, 10, 11	**--**
		6.1.2	Power Series Solutions	15, 17, 20, 22, 32	**--**
10	Apr 15-19	6.2	Solutions about Singular Points[©]	3, 10, 13, 14, 19, 20, 27	**(ex 5)**
11	Apr 22-26	*App II*	Matrices and Linear Systems (*review*)	14, 15, 19, 23, 27, 29, 31, 33, 39, 43	**--**
			The Eigenvalue Problem	47, 49, 52, 53, 55	**--**
12	Apr 29-May 03	8.1	Preliminary Theory	4, 5, 8, 14, 15, 17, 23, 25	**--**
		8.2	Homogeneous Linear Systems		
13	May 06-10	8.2.1	Distinct Real Eigenvalues	3, 7, 10, 13	**(ex 2)**
		8.2.2	Repeated Eigenvalues	19, 21, 23, 25, 27	**--**
		8.2.3	Complex Eigenvalues	33, 34, 36, 39, 41, 45	**--**
14	May 13-17	8.3	Nonhomogeneous Linear Systems		
		8.3.2	Variation of Parameters	11, 12, 23, 32	**(35 (a,b))**
		8.4	Matrix Exponential	1, 5, 9, 2, 6, 4, 8	**(27(a))**
15	May 20-24	--	Pace Adjustment		
	+ May 27*		Review		

*Thursday: Normal Saturday Classes.   **Last day of classes: Sunday, May 28, 2006.
▪   For remarks about Homework Problems, **CAS** Assignments and exams, see the following page.

[©] Some statements about Bessel's equation and Legendre's equation should be included in the final remarks about Series Solutions. See the introductory paragraph of Section 6.3 in page 259.

The Syllabus (Cont'd): Remarks

Homework:

- The selected homework problems indicate the levels of the breadth and the depth of coverage. To acquire proficiency on solution methods, the students are strongly urged to solve much more problems than indicated in the syllabus.

- In Sec. 8.4, problems 1, 5 and 9 refer to the same matrix. The same is true for problems 2 and 6 and problems 4 and 8. The matrix e^{At} is to be computed by the definition given in (3). The material on *Laplace Transform* in page 362 is, of course, *omitted*.

Computer Algebra Systems (CAS) [Mathematica, Matlab, Maple, …]:

- CAS assignments are at the discretion of the instructor.

- The entire assignments may be divided into *two* parts and collected *twice* as "projects".

- The selected assignments are *simple*. In general, nothing is required beyond typing the **commands** given in the textbook and then, for *Mathematica*, pressing SHIFT---ENTER. The students are urged to try various types of problems.

- For assignments no. 55 in Sec. 1.1 and no. 27(a) in Sec. 8.4, the following commands can be used in *Mathematica*:

<table>
<tr><td><u>**(1.1) – 55:**</u></td><td><u>**(8.4) – 27(a):**</u></td></tr>
<tr><td>Clear[y]</td><td>A={{4,2},{3,3}};</td></tr>
<tr><td>y[x_]:=x Exp[5 x] Cos[2 x]</td><td>c={c1,c2};</td></tr>
<tr><td>y[x]</td><td>m=MatrixExp[A t];</td></tr>
<tr><td>Simplify [y'''[x] − ⋯ ⋯ ⋯ 841 y[x]]</td><td>sol=Expand[m.c]</td></tr>
<tr><td></td><td>Collect[sol,{c1,c2}]//MatrixForm</td></tr>
</table>

Review Material: In the introduction of each section in the textbook, *review material*, if any, is indicated. The **student** must do all reviews. He should make a plan, based on the Syllabus, for all the reviews required for the course.

Exams:

- The following dates for Major Exams I and II are set by the College of Sciences to avoid conflicts with other exams:
  - <u>Exam I:</u> Wednesday, March 15, 2006.
  - <u>Exam II:</u> Wednesday, April 19, 2006.

- The date, time and the place of the Final Exam will be announced by the Registrar.

- The Final Exam is Comprehensive.

Attendance:

- Attendance is compulsory. KFUPM policy with respect to attendance will be strictly enforced.

******Best Wishes for a Pleasant Semester******