

Spring 2016

Bruce DeVantier

ENGR 351

NUMERICAL METHODS IN ENGINEERING

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Office Hours: 10:00-12:45 M-W-F

Required Text: **Numerical Methods for Engineers**, Steven Chapra and Raymond Canale, Seventh (Sixth) Edition, 2015 (2010), McGraw-Hill Publishing Company, ISBN 9780073397924 (9780073401065).

Recommended Workbook & Notes: Printing Plant, 606 S. Illinois Avenue, Carbondale

#### Course Organization:

Homework: Assigned in sets, due as printed, 25 % of total grade. All answers must be accompanied by justification and by explanation. Requested plotting of results can be done by hand or by computer. Do hand calculations when specified with a handheld scientific **calculator (bring to classes)**. Exams: 3 In-term exams-15% each of total grade, final exam- 30% of total grade.

#### Grading Policy:

- Grading scale will be relative, but any grade below 50% should be considered failing.
- Late homework is not accepted, a valid excuse will be grounds to have the zero grade dropped.
- It is the student's responsibility to make sure that all material to be graded is included in any assignment or exam papers, i.e. "Here is a sheet I forgot to include" will not be a valid excuse for late material. Also, alternate solutions of a given problem will receive equal weight. So that if a problem is worth 10 points, two alternate solutions would be worth 5 points each. Any exam work that you do not wish to be graded should be so marked.
- Attendance will be monitored, although it is required only on the days of exams. Students having three or fewer absences will be allowed to drop the lowest in-term exam.
- There will be no make-up exams. A valid excuse will be grounds to have the remaining in-term exams weighted at 22.5 % each.
- Any complaints concerning grading of an exam must be lodged immediately after the class period in which the exam is returned. Leaving the class with the exam in hand will be assumed to be tacit acceptance of the grade.
- The student is reminded that academic misconduct such as submitting work not that of the student, or any sort of cheating on tests can result in a failing grade for the course, conduct board penalties, or both. Group work on homework is encouraged, but each student must create his or her own computations and write-ups for submission (no hand or electronic copying).

## TENTATIVE COURSE OUTLINE

Date	Topic	Related Reading
1/18	***** Martin Luther King Day Holiday *****	
1/20	Introduction	Ch. 1
1/22	Number Representations	Ch. 3
1/25	Round-off and Other Errors	“
1/27	Taylor Series	Ch. 4
1/29	Roots of Non-Linear Equations, Bracketing Methods	Ch. 5
2/1	Bisection, and False Position	“
2/3	Open Methods, Fixed Point Iteration, Newton-Raphson	Ch. 6
2/5	Simultaneous Nonlinear Equations	“
2/8	Linear Algebraic Equations & Matrix Methods	Pre-Ch. 9
2/10	Matrix Manipulation, Cramer’s Rule	“
2/12	Gauss Elimination, Review for First Exam	Ch. 9
2/15	***** FIRST IN-CLASS EXAM *****	Chs. 1, 3-6
2/17	Gauss-Jordan	Ch. 9
2/19	Matrix Inversion	Ch. 10
2/22	Gauss-Siedel and Jacobi Iteration	Ch. 11
2/24	1-D Optimization Methods, Golden Search	Ch. 13
2/26	Newton Search in 1-D	“
2/29	Multi-D Direct and Gradient Methods	Ch. 14
3/2	Constrained Optimization	Ch. 15
3/4	Statistics & the Normal Probability Distribution	Part 5 Background
3/7	Curve Fitting	Ch. 17
3/9	Linear Regression	“
3/11	Confidence Intervals of Regression	“
3/12-3/20	*****Spring Break*****	
3/21	“Linearized” Regression	Ch. 17
3/23	Nonlinear Regression	“
3/25	Polynomial Interpolation, Newton’s Divided Differences	Ch. 18
3/28	Direct Coef. Determination, Review for Second Exam	Ch. 18
3/30	***** SECOND IN-CLASS EXAM *****	Chs. 9-11, 13-15
4/1	Lagrange Interpolation	Ch. 18

## TENTATIVE COURSE OUTLINE, Continued

Date	Topic	Related Reading
4/4	Numerical Integration, Trapezoidal Rule	Ch. 21
4/6	Simpson's Rule	Ch. 21
4/8	Rhomberg Integration	Ch. 22
4/11	Gauss Quadrature	Ch. 22
4/13	Numerical Differentiation	Ch. 23
4/15	Ordinary Differential Equations	Ch. 25
4/18	Euler & Modified Euler Methods	“
4/20	Runge Kutta Methods	Ch. 25
4/22	Simultaneous & Higher Order ODEs	“
4/25	Partial Differential Equations	Ch. 29
4/27	Finite Difference Method, Review for Third Exam	Ch. 29
4/29	***** THIRD IN-CLASS EXAM*****	Chs. 17, 18, 21, 23, 25
5/2	Time Dependent Finite Differences	Ch. 30
5/4	Explicit vs. Implicit Finite Difference Solutions	“
5/6	Course Review	
5/13	***** Final Exam, Friday, 12:30-2:30 pm *****	

## IMPORTANT DATES \*

<u>Semester Class Begins</u> .....	<b>01/19/2016</b>
<u>Last day to add a class</u> (without instructor permission):.....	<b>01/25/2016</b>
<u>Last day to withdraw completely and receive a 100% refund</u> :.....	<b>02/07/2016</b>
<u>Last day to drop a course using SalukiNet</u> :.....	<b>04/14/2016</b>
<u>Last day to file diploma application</u> (for name to appear in Commencement program):.....	<b>02/05/2016</b>
<u>Final examinations</u> :.....	<b>05/09–05/13/2016</b>

Note: For outreach, internet, and short course drop/add dates, visit Registrar's Academic webpage <http://registrar.siu.edu/>

## SPRING SEMESTER HOLIDAYS

Martin Luther King, Jr.'s Birthday Holiday 01/18/2016  
Spring Break 03/12—03/20/2016

## WITHDRAWAL POLICY ~ Undergraduate only

Students who officially register for a session may not withdraw merely by the stopping of attendance. An official withdrawal form needs to be initiated by the student and processed by the University. For the proper procedures to follow when dropping courses and when withdrawing from the University, please visit <http://registrar.siu.edu/pdf/ugradcatalog1314.pdf>

## INCOMPLETE POLICY~ Undergraduate only

An INC is assigned when, for reasons beyond their control, students engaged in passing work are unable to complete all class assignments. An INC must be changed to a completed grade within one semester following the term in which the course was taken, or *graduation*, whichever occurs first. Should the student fail to complete the course within the time period designated, that is, by no later than the end of the semester following the term in which the course was taken, or graduation, whichever occurs first, the incomplete will be converted to a grade of *F* and the grade will be computed in the student's grade point average. For more information please visit: <http://registrar.siu.edu/grades/incomplete.html>

## REPEAT POLICY

An undergraduate student may, for the purpose of raising a grade, enroll in a course for credit no more than two times (two total enrollments) unless otherwise noted in the course description. For students receiving a letter grade of A,B,C,D, or F, the course repetition must occur at Southern Illinois University Carbondale. Only the most recent (last) grade will be calculated in the overall GPA and count toward hours earned. See full policy at <http://registrar.siu.edu/pdf/ugradcatalog1314.pdf>

## GRADUATE POLICIES

Graduate policies often vary from Undergraduate policies. To view the applicable policies for graduate students, please visit <http://gradschool.siu.edu/about-us/grad-catalog/index.html>

## DISABILITY POLICY

Disability Support Services provides the required academic and programmatic support services to students with permanent and temporary disabilities. DSS provides centralized coordination and referral services. To utilize DSS services, students must come to the DSS to open cases. The process involves interviews, reviews of student-supplied documentation, and completion of Disability Accommodation Agreements. <http://disabilityservices.siu.edu/>

## PLAGIARISM

Student Conduct Code [http://srr.siu.edu/student\\_conduct\\_code/](http://srr.siu.edu/student_conduct_code/)  
Guidelines for Faculty [http://pvcaa.siu.edu/\\_common/documents/Plagiarism/Guide%20to%20Preventing%20Plagiarism.pdf](http://pvcaa.siu.edu/_common/documents/Plagiarism/Guide%20to%20Preventing%20Plagiarism.pdf)

## MORRIS LIBRARY HOURS

<http://www.lib.siu.edu/about>

## SAFETY AWARENESS FACTS AND EDUCATION

Title IX makes it clear that violence and harassment based on sex and gender is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, etc. If you or someone you know has been harassed or assaulted, you can find the appropriate resources here: <http://safe.siu.edu>

## SALUKI CARES

The purpose of Saluki Cares is to develop, facilitate and coordinate a university-wide program of care and support for students in any type of distress—physical, emotional, financial, or personal. By working closely with faculty, staff, students and their families, SIU will continue to display a culture of care and demonstrate to our students and their families that they are an important part of the community. For Information on Saluki Cares: (618) 453-5714, or [siucares@siu.edu](mailto:siucares@siu.edu), <http://salukicare.siu.edu/index.html>

## EMERGENCY PROCEDURES

Southern Illinois University Carbondale is committed to providing a safe and healthy environment for study and work. We ask that you become familiar with the SIU **Emergency Response Plan** and **Building Emergency Response Team (BERT)** programs. Please reference the **Building Emergency Response Protocols for Syllabus** attachments on the following pages. *It is important that you follow these instructions and stay with your instructor during an evacuation or sheltering emergency.*

## INCLUSIVE EXCELLENCE

SIU contains people from all walks of life, from many different cultures and sub-cultures, and representing all strata of society, nationalities, ethnicities, lifestyles, and affiliations. Learning from and working with people who differ is an important part of education as well as an essential preparation for any career. For more information please visit: <http://www.inclusiveexcellence.siu.edu/>

## LEARNING AND SUPPORT SERVICES

Help is within reach. Learning support services offers free tutoring on campus and math labs. To find more information please visit the Center for Learning and Support Services website:

**Tutoring** : <http://tutoring.siu.edu/>

**Math Labs** [http://tutoring.siu.edu/math\\_tutoring/index.html](http://tutoring.siu.edu/math_tutoring/index.html)

## WRITING CENTER

The Writing Center offers free tutoring services to all SIU students and faculty. To find a Center or Schedule an appointment please visit <http://write.siu.edu/>

## AFFIRMATIVE ACTION & EQUAL OPPORTUNITY

Our office's main focus is to ensure that the university complies with federal and state equity policies and handles reporting and investigating of discrimination cases. For more information visit: <http://diversity.siu.edu/#>

## Additional Resources Available:

**SALUKINET**: <https://salukinet.siu.edu/cp/home/displaylogin>

**ADVISEMENT**: <http://advisement.siu.edu/>

**SIU ONLINE**: <http://online.siu.edu/>