ENG 342 - Advanced Engineering Mathematics II

Fall Semester, 2016

Instructor

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Course Information

Meeting times: Tuesdays and Thursdays from 5:30 – 6:50pm in AR-136.
Prerequisite: ENG 272
1 course unit

Course Description

This course is divided into two parts:

The first half of the semester focuses on partial differential equations and Fourier analysis. Topics covered include: orthogonal functions, Fourier series, solutions to second order partial differential equations (heat, wave and Laplace's), Fourier integrals/transforms.

The second half is on probability and statistics. Topics covered include: continuous and discrete probability distributions, the central limit theorem, confidence intervals, hypothesis testing, correlation, and regression.

4th Hour Activity

Students will complete additional problem-solving using MATLAB. In-class demos will be given on an as-needed basis for how to apply MATLAB to solving mathematical problems. Computer problems will be assigned during the course of the semester as an additional component of the homework assignments, as explained below.

Textbooks

- (First half) Advanced Engineering Mathematics, 5th Edition by Zill and Wright
- (Second half) Statistics For Engineers And Scientists, 4th Edition By Navidi

Evaluation
This class will have four types of evaluations:

1. *Quizzes* (45%)

There will be around 8 quizzes throughout the semester, given in class. Each quiz will take 20-30 minutes of a lecture (the rest of the time being used to continue through the material). No calculators, computers, books, phones, or any other source is permitted: a pencil, your brain, and the formulas provided on the quiz paper is all that you will need.

Each quiz will count equally towards your final grade, though different questions in a quiz may have different numbers of points depending on their difficulty. At the end of the semester, your lowest quiz grade will be dropped.

Quizzes will be given at the beginning of class (i.e., from 5:30 to 5:50 or 6:00), so it is important for you to be on time. If you cannot make it for a quiz, you must get approval and re-schedule with the instructor in advance; otherwise you will receive a grade of zero on that quiz.

2. *Homework and Computer Simulations* (25%)

There will be around 5 homework assignments throughout the semester, one due roughly every 3 weeks at the beginning of class. Each homework will consist of several problems from the textbooks as well as one or two computer simulations that will require MATLAB. Similar to quizzes, each homework will count equally towards your final grade, though different problems may be worth different numbers of points.

It is perfectly fine – within reason – to work together on the homeworks, and even to consult a solution manual to check your work. That being said, there will be absolutely NO tolerance for copying from each other or from another source. Each step to a problem's solution must be written out, in much more detail than any solution manual will give.

In general, late submissions will not be accepted, unless approval is granted by the instructor in advance. Homeworks will be graded and solutions posted generally one week later.

3. *Final Exam* (25%)

There will be one comprehensive final exam at the end of the semester. As with the quizzes, no calculators, computers, etc. are permitted. The questions on this exam will be similar in nature to those in the quizzes and homeworks.

4. *Class Attendance and Attentiveness* (5%)

The purpose of this is to encourage you to attend every class that you can. You should also be attentive during the lecture; there are many ways to show you are engaged, one being to answer questions as they are asked.

Course Topics and Tentative Schedule

The following is a tentative schedule of when different topics will be covered, quizzes administered, and homeworks due. However, we may deviate from this depending on how much time different topics take to cover.

Partial Differential Equations and Fourier/Laplace Analysis (Weeks 1 to 8)
Chapter 12: Orthogonal Functions, Fourier Series (Weeks 1, 2, 3: 8/30, 9/1, 9/8 – 9/15)
12.1 Orthogonal Functions
12.2 Fourier Series
Quiz 1: 9/13
12.3 Fourier Cosine and Sine Series
12.4 Complex Fourier Series
Chapter 13: BVPs in Rectangular Coordinates (Weeks 4, 5, 6, 7: 9/20 – 10/13)
Homework 1 Due: 9/20
13.1 Separable PDEs
13.2 Classical Equations and BVPs
13.3 Heat Equation
Quiz 2: 9/27
13.4 Wave Equation
No Class (10/4)
13.5 Laplace's Equation
Fall Break: No Class (10/11)
Chapters 14-15: BVPs in other Coordinate Systems and Integral Transforms (Weeks 7-8: 10/13 – 10/20)
Quiz 3: 10/18
14.1 Problems in Polar Coordinates
Probability and Statistics (Weeks 9 to 15)
Chapter 1: Sampling and Descriptive Statistics (Week 9: 10/25)
Homework 2 Due: 10/13
1.1 Sampling
1.2 Summary Statistics

1.3 Graphical Summaries
Chapter 2: Probability (Weeks 10, 11: 10/27 – 11/3)
2.1 Basic Ideas
2.2 Counting Methods
2.3 Conditional Probability and Independence
Quiz: 11/1
2.4 Random Variables
2.5 Linear Functions of Random Variables
2.6 Jointly Distributed Random Variables
No Class (11/3)
Chapter 4: Commonly Used Distributions (Weeks 12, 13: 11/8 – 11/15)
4.1The Bernoulli Distribution
4.2 The Binomial Distribution
4.3 The Poisson Distribution
Homework Due: 11/10
4.5 The Normal Distribution
4.7 The Exponential Distribution
4.8 The Uniform Distribution
4.11 The Central Limit Theorem
Quiz: 11/15
Chapter 5: Confidence Intervals (Weeks 12, 13: 11/17, 11/22)
5.1 Large-Sample Confidence Intervals for a Population Mean
5.2 Confidence Intervals for Proportions
Quiz: 11/22
Homework Due: 11/22
5.3 Small-Sample Confidence Intervals for a Population Mean
Thanksgiving Break: No Class (11/24)
Chapter 6: Hypothesis Testing (Weeks 14, 15: 11/29 – 12/6)
6.1 Large-Sample Tests for a Population Mean
6.2 Drawing Conclusions from the Results of Hypotheses Tests
6.3 Tests for a Population Proportion
Quiz: 12/6
6.4 Small-Sample Tests for a Population Mean
6.9 Distribution-Free Tests
6.10 Tests with Categorical Data

Chapter 7: Correlation and Simple Linear Regression (Week 15: 12/6, 12/8)
7.1 Correlation
7.2 The Least-Squares Line
Homework Due: 12/8
Final Exam: 12/13

Course Objectives

1. To understand Fourier series, integrals, and transforms and their engineering use. [a, k]
2. To understand and solve partial differential equations, in particular, the wave equations governing the vibrating string and vibrating membrane, the heat equation and the Laplace equation. [a, k]
3. To understand and apply data analysis and probability theory and to set up mathematical models of processes that are affected by chance. [a, k]
4. To understand and apply mathematical statistics to design and evaluate random experiments to obtain information about practical problems. [a, k]

Performance Criteria

1. The student will be able to develop the expansion of periodic signals in harmonics and use them to analyze the response of continuous and discrete time-linear, time-invariant systems to periodic inputs.
2. The student will be able to derive the PDEs of various systems and apply methods (initial and boundary value problems) to obtain solutions satisfying conditions that are given in the physical situation.
3. The student will be able to handle data numerically or graphically and extract information from them.
4. The student will apply estimation of parameters, determination of confidence intervals and hypothesis testing in applications such as quality control and acceptance sampling.

Engineering Student Outcomes

The Student Outcomes listed below are expected to be achieved of all graduates of the Engineering Programs by the time of graduation. Underlined are student outcomes practiced in this course.

a. an ability to apply knowledge of mathematics, science and engineering;
b. an ability to design and conduct experiments, as well as to analyze and interpret data;
c. an ability to design a system, component, or process to meet desired needs;
d. an ability to function in multidisciplinary teams;
e. an ability to identify, formulate and solve engineering problems;
f. an understanding of professional and ethical responsibility;
g. an ability to communicate effectively;
h. the broad education necessary to understand the impact of engineering solutions in a global and societal context;

i. a recognition of the need for and an ability to engage in life-long learning;
j. a knowledge of contemporary issues;
k. an ability to use the techniques, skills and modern engineering tools necessary for engineering practice;

SELECTED TCNJ POLICIES

The activities of this course are subject to the policies of The College of New Jersey. The following selected policies are referenced here for easy access via the links provided. All links are current as of August 29, 2016.

Final Examinations
Policy is available on the web: http://policies.tcnj.edu/policies/digest.php?docId=9136

Absence and Attendance Policy
Policy is available on the web: http://policies.tcnj.edu/policies/digest.php?docId=9134

Academic Integrity Policy
Policy is available on the web: http://policies.tcnj.edu/policies/digest.php?docId=7642

Americans with Disabilities Act (ADA) Policy
Policy is available on the web: http://policies.tcnj.edu/policies/digest.php?docId=8082.
Disability support services website*:* http://differingabilities.pages.tcnj.edu.