THOMPSON RIVERS UNIVERSITY

Course Outline

Department of Mathematics and Statistics
School of Advanced Technologies and Mathematics

MATH 3160 – 3 Credits
Differential Equations II (3,1,0)
Fall, 2011

Instructor: Dr. Richard Taylor Phone: (250) 371-5987
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Office Hours: M 1:30–2:20; W 9:30–10:20; R 9:30–11:20; F 9:30–10:20

Calendar Description

This course has three parts. The first part examines some methods for solving ordinary differential equations. Power series methods are applied to obtain solutions near ordinary points and regular singular points, and the real Laplace transform is discussed. The second part deals with Sturm-Liouville boundary-value problems, Fourier series, and other series of eigenfunctions, including Fourier-Bessel series. The final part is an introduction to boundary-value problems involving partial differential equations, primarily the heat equation, the wave equation and Laplace's equation, with applications in physics. The method of separation of variables is used.

Education Objectives/Outcomes

On completion of the course students will be expected to be familiar with the various types of equations considered in this course, appreciate some of their applications, and be proficient at solving these equations using a number of analytical methods.

Prerequisites

Math 2240 (Differential Equations I) or equivalent.

Texts/Materials

Required:
D. G. Zill and M. R. Cullen, *Differential Equations with Boundary-Value Problems*, 7th Edition, Brooks/Cole, 2009.

Recommended:
Student Solutions Manual and Study Guide for *Differential Equations with Boundary-Value Problems.*

Student Evaluation

Weekly quizzes (×8) 15%
Midterm exams (×2) 40%
Final exam 45%

Missed quizzes and exams will result in a mark of zero unless the student provides a valid reason and receives prior approval from the instructor.

NOTE: The final examination will be written at a time between December 5 and December 17, as scheduled by the Registrar's Office. The examination could be scheduled at any time during this period. Students should plan accordingly.

For detailed information on policies and regulations regarding examinations please refer to the TRU calendar.

Course Topics

1. **Power Series Solutions** (2 weeks)
   Review of power series
   Power series solutions
   Cauchy-Euler equations
   Classification of singular points
   Series solutions about a regular singular point
   Bessels equation and Bessel functions

2. **Laplace Transform** (2.5 weeks)
   Introduction to the Laplace transform Section
   Inverse transform and transforms of derivatives
   Translation theorems and step functions
   Derivatives of transforms, convolution
   Dirac delta function
   Linear systems

3. **Orthogonal Functions and Fourier Series** (2.5 weeks)
   Orthogonal functions
   Calculation of Fourier series
   General facts about Fourier series
   Fourier cosine and sine series
   Regular Sturm-Liouville problem
   Series of eigenfunctions

4. **Boundary-value Problems in Rectangular Coordinates** (3.5 weeks)
   Separable partial differential equations
   The heat equation
   The wave equation
   Laplaces equation
   Nonhomogeneous equations and boundary conditions
   Use of generalized Fourier series
   Problems in higher dimensions

5. **Boundary-value Problems in Other Coordinate Systems** (1.5 weeks)
   Laplaces equation in polar coordinates
   Problems involving Bessel functions