THOMPSON RIVERS UNIVERSITY

Course Outline

Department of Mathematics & Statistics
Faculty of Science

MATH 2240 – 3 Credits
Differential Equations I (3,1,0)
Winter, 2015

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Calendar Description

This course deals with ordinary differential equations and related initial-value problems, emphasizing their many applications in science and engineering. Methods are discussed for solving such equations either exactly or approximately. Topics include first-order equations, higher order linear equations, modelling with differential equations, systems of linear equations, and phase plane analysis of nonlinear systems.

Prerequisites

MATH 2110 (Calculus III) and MATH 2120 (Linear Algebra I).

Texts/Materials

Required:
D. G. Zill and M. R. Cullen, *Differential Equations with Boundary-Value Problems*, 8th Edition, Brooks/Cole, 2013.

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 April 16 and April 28, 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. **First Order Differential Equations**

   Definitions & Terminology 1.1
   Existence & Uniqueness of Solutions to Initial Value Problems 1.2
   Direction Fields and Geometric Solutions 2.1
   Separable DE 2.2
   Linear First-Order DE 2.3
   Exact DE 2.4
   Homogeneous DE 2.5
   Approximate Solutions (Euler's Method) 2.6
   Applications
   Linear Models 3.1
   Non-linear Models 3.2

2. **Higher Order Differential Equations**

   Initial Value Problems and Boundary Value Problems 4.1
   Reduction of Order 4.2
   Homogeneous Linear DE with Constant Coefficients 4.3
   Nonhomogeneous Linear DE
   Method of Undetermined Coefficients 4.4
   Variation of Parameters 4.6
   Applications of Second-Order DE
   Spring/Mass Systems & Electric Circuits 5.1
   Planar Pendulum 5.3

3. **Numerical Solution of Ordinary Differential Equations**

   Euler Methods 9.1
   Runge-Kutta Methods 9.2

4. **Systems of Differential Equations**

   Connected Mixing 3.3
   Spring/Mass Systems & Electric Circuits 7.6
   Homogeneous Linear Systems 8.2
   Non-Homogeneous Linear Systems 8.3
   Autonomous Systems 10.1
   Stability of Linear Systems: Phase Portraits and Stability 10.2
   Linearization and Local Stability 10.3