Exam I Review Boyce/10ed/Ch1&2 Halleck MAT 2680 NYCCT (CUNY) Fall 2013

***Chapter* 1: Introduction**

***Definitions:***

* Differential Equation
* Mathematical Model (falling object with air resistance, prey population with constant harvest and pendulum)
* Direction (Slope) Field
* Equilibrium Solution (Stable, Unstable & Semi-stable)
* Rate (growth) constant
* Initial Condition, Initial Value Problem (IVP)
* General Solution, Integral curves
* Ordinary Differential Equation (ODE), Partial Differential Equation (PDE)
* Order, Linear, Nonlinear

***Important Skills:***

* Derive differential equations that mathematically model simple problems. (Ex. 1, p. 2; Also see p. 7)
* Construct a direction field for a first order ODE, and sketch approximate solutions. (Ex. 2, p. 3)
* Graph the integral curves of a general solution. (Ex. 2, p. 13)
* Know what an initial value problem is, and how to show a given function is a solution to one. (Ex. 2, p. 13)
* Know the difference between an ordinary differential equation and partial differential equation. (p. 19)
* Derivation of pendulum differential equation (p. 21)
* Know how to classify differential equations as order, and linearity. (p. 20 - 21)

***Chapter* 2: First Order Differential Equations**

***Definitions:***

• First Order Ordinary Differential Equation

• Integrating Factor, Linear equations

• Separable

• Homogeneous differential equations

• Implicit solutions

• Bernoulli Equations

• Existence and Uniqueness of Solutions General Sol’ns,

• Integrating Factor, Exact equations

• Tangent Line Method (Euler's Method)

***Theorems:***

• Theorem 2.4.1: Existence and uniqueness of solutions to linear first order ODE's. (p. 69)

• Theorem 2.4.2: Existence and uniqueness of solutions to first order IVP's. (p. 70)

• Theorem 2.6.1: Existence and uniqueness of solutions to exact first order ODE's. (p. 96)

***Important Skills:***

• Determine if a first order ODE is linear or nonlinear. Equation (3) on page 32 gives the form for a linear ODE.

• If the differential equation is linear, compute the integrating factor, and then the general solution. (Ex. 4, p. 37)

• Be able to graph integral curves for an ODE. (Ex. 4, p. 38)

• If it's nonlinear, is it separable or homogeneous? If so, you will need to compute two different integrals.

• It is crucial to know integration of basic functions and integral methods from your calculus course. For Example, various substitutions, integration by parts, and partial fractions will all be utilized. (Ex. 2 & 3, p. 45 & 46)

• If the ODE is not separable or homogeneous, is it exact? If so, solve it using the method in section 2.6. (Ex. 2, p. 98)

• If it isn't linear, separable, homogeneous or exact, check for Bernoulli.

• Bernoulli equations can be transformed into linear equations.

• What happens to solutions as time tends to infinity or a finite time barrier? Understand stability and instability.

• Know how to obtain approximate solutions using Euler's method if an analytical solution cannot be found. (Ex. 2, p. 107)

**Exam is 1 hour 15 minutes.**

**Ok**: handwritten notes, calculator (TI 83/84) **Not ok**: printouts, book, **TI 89,** laptop, tablet, cell phone or other handheld

**Part I** (30%, 10 min) ~ quizzes: fill in blank, short answer, T-F, matching. Emph: defs, thms & analysis using slope field.

**Part II** (15%, 15 min) Linear first order IVP with nonconstant coefficients (explicit sol’n)

**Part III** (15%, 15 min) Exact equation which requires an I.F, like p 134 #31. (1st verify exactness, implicit sol’n)

**Part IV** (10%, 10 min) Euler method for numerical solution

**Part V** (30%, 20 min) 3 1st order nonlinear eqtns. Identify type, provide 1st few steps for sol’n, & check soln (will be given). For practice, do p. 133 #1-32 (not 31). Solutions will be posted on the openlab by Friday 10/4, 11:59 PM.