Exam 2 Info

Date: April 14th, 2016

Location: Normal classroom (ARC-205, Busch Campus)

Time: In-class (1:40-3:00 pm)

Notes:

1. There will be **no** MATLAB questions on this exam.
2. You are allowed to bring **one** sheet of **handwritten** notes as a reference during the exam. I will not allow any typed sheets to be used, including the lecture notes (i.e. the main text).
3. Calculators, cell phones, computers, etc. are **prohibited**. All calculations will be able to be completed by hand.

Suggestions:

1. Read over covered sections in ES notes.
2. Understand all assigned homework questions (solutions on Sakai).
3. Solve other (unassigned) homework questions (Section 2.10 in the notes, only those relevant to the material covered on this exam).

Material:
All material covered since Exam 1 (thus starting at Epidemiology) up until Thursday's class (April 7th) is fair-game for the exam. Roughly this includes the material from Section 2.5 to 2.8 in the notes, but **excluding** Section 2.8.5 (Bendixson's Criterion for proving that a periodic orbit does **NOT** exist. I will cover this, and it will appear on the Final Exam). Of course you will expected to know some material introduced before Exam 1, such as local stability via the Jacobian and nullcline analysis (there is more as well). Some key topics to review are given below. But be aware: this list is **not** exhaustive, and anything covered could appear on the exam.

(a) Epidemiology: model interpretation and analysis

(b) Chemical kinetics

- (i) Derivation of ODEs using mass action
- (ii) Formulation of systems as chemical reaction networks (CRN), i.e. $\dot{S} = \Gamma R(S)$
- (iii) Determination of a basis of conservation laws, and hence reduction of the dimensionality of the ODE system

(c) Enzymatic reactions

- (i) Modeling basic enzyme reactions (derivation and interpretation)
- (ii) Quasi-steady state (Michaelis-Menten) approximation (what it means, how to use it, and why it works)
- (iii) Models of enzyme inhibition

(iv) Sigmoidal response and cooperativity (hyperbolic vs. sigmoidal response, and how it can lead to multi-stability and "switch"-like behavior)

(d) Periodic behavior

(i) Limit cycles (why these are "physical" periodic trajectories, vs. simple-harmonic motion)

(ii) Poincaré-Bendixson theorem and how to apply it (finding regions D where a periodic orbit is **guaranteed** to exist)

As with last exam, **model formulation and interpretation is important**. You should be comfortable with the arguments made to derive many of the equations, as well as the assumptions used in the various formulations.