DE LA SALLE UNIVERSITY – MANILA
COLLEGE OF SCIENCE
Mathematics Department

SYLLABUS

COURSE CODE	MTH679M/D
COURSE TITLE	Introduction to Mathematical Modeling
CLASS DAY & TIME	
ROOM	
NAME OF FACULTY	
COURSE CREDIT	3 Units
CONTACT NO. (DEPT)	(02) 536-0270, (02) 524-4611 loc. 420/413
TERM/SCHOOL YEAR	

COURSE DESCRIPTION

This course is an introduction to the interdisciplinary research field of mathematical modeling. It introduces basic approaches of mathematical modeling and techniques in computational simulations of nonlinear dynamical systems in the life sciences and economics.

COURSE OBJECTIVES

The students will:

1. approach a real problem,
2. know how to break the problem down into manageable parts, and
3. set up mathematical/ computational model that contains the key elements of the problem.
4. Exhibit values like:
   - cooperation through group study;
   - honesty by claiming credit only for the work he has done;
   - zeal and seriousness of intent to learn by participating actively in class discussion, doing his homework regularly and consulting his mentor;
   - patience, perseverance and diligence by solving assigned exercises completely including the difficult ones;
   - faith by doing what is right and giving his best in performing any assigned task;
   - show concern for the community through sharing of know-how and resources during group discussion;
   - self-reliance by being able to solve problems independently.

Topic/Subtopic	Learning Strategies/ Activities	Week/Meeting
I. Introduction to Different Modeling Approaches a. Goals, Inputs, and Initial Exploration on Question of Scale and Data Availability b. Model Selection and Design i. Model Structure	Lecture-Discussions Paper Review Exercises Problem Solving Use of Cell Designer, R,	1-2

Topic/Subtopic	Learning Strategies/ Activities	Week/Meeting
ii. System Component iii. Model Representations c. Model Analysis and Diagnosis d. Model Use and Application	MATLAB, PLAS, and/or Mathematica (Wolfram Alpha)	
II. Paper Review	Group work	3-4
III. Introduction to Dynamic Models a. Interaction Graph b. Steady State Analysis c. Stability Analysis d. Eigenvalue Methods e. Phase Portraits f. Bifurcation Analysis g. Sensitivity Analysis	Lecture-Discussions Paper Review Exercises Problem Solving Use of Cell Designer, R, MATLAB, PLAS, and/or Mathematica (Wolfram Alpha)	5-8
IV. Paper Review	Group work	9-10
V. Modeling using Ordinary Differential Equations a. Model construction b. Model simulation c. Model calibration d. Model validation and analysis e. Sensitivity and Robustness	Lecture-Discussions Paper Review Exercises Problem Solving Use of Cell Designer, R, MATLAB, PLAS, and/or Mathematica (Wolfram Alpha)	11-12
VI. Paper Review	Group work	13
VII. Case Studies	Lecture-Discussions Paper Review Group work Exercises Problem Solving Use of Cell Designer, R, MATLAB, PLAS, and/or Mathematica (Wolfram Alpha)	14

TEACHING STRATEGIES

To achieve the course objectives, a combination of lecture, group discussion and solution of problem sets (through computational methodology) will be done in & out the class. The students are advised to learn how to use computational software like Mathematica, Matlab, SAS, R, and etc. The students will model practical problems which involve the interpretation of data, the (mathematical/computational) formulation of the problem, an analysis of the mathematical/computational model, a numerical solution, and an interpretation of the results. The students will look at case studies that illustrate a number of important principles.

COURSE REQUIREMENTS

- Oral Presentation 40%

- Final Paper 60%

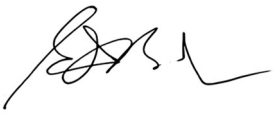
SOURCES

- M. M. Meerschaert, *Mathematical Modeling, Fourth Edition*, 4 edition. Amsterdam ; Boston: Academic Press, 2013.
- E. Voit, *A First Course in Systems Biology*. Taylor & Francis, 2012.
- H. Kitano, "Computational systems biology," *Nature*, vol. 420, no. 6912, pp. 206–210, Nov. 2002.
- K. Schittkowski, *Numerical Data Fitting in Dynamical Systems: A Practical Introduction with Applications and Software*, 1st ed. Springer, 2002.
- L. Perko, *Differential Equations and Dynamical Systems*, 3rd ed. 2001. Corr. 3rd printing. Springer, 2008.
- I.-C. Chou and E. O. Voit, "Recent Developments in Parameter Estimation and Structure Identification of Biochemical and Genomic Systems," *Math. Biosci.*, vol. 219, no. 2, pp. 57–83, Jun. 2009.

JOURNAL REFERENCES

- (List of journal articles will follow)

Noted by:



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