Course Name and No. XXXX: Introduction to Mathematical Modeling

Quarter, Year, Date and Hours: XXX
Project preparation week and presentation: XXX
Classroom: XXX

Instructor: XXX **Office Hours: XXX**
Office Location: XXX **Tel: XXX-XXXX**
Email: XXX **Course website: XXX**

Textbook: *"Introduction to Modern Mathematical Modeling with R and Python"* Lecture notes authored by Samuel Shen.

Prerequisites: Math 254: Introduction to Linear Algebra

Topics covered in this course: Dimensional analysis, Python programming, linear regression models, linear algebra models, probability models, calculus models, differential equation models, stochastic models, big data models, data visualization models, machine learning, and real-world applications (e.g., big climate data visualization www.4dvd.org).

Grading Policy: The final grades for this class will be determined as follows:

Homework assignments (3 times)	30%
Midterm exam	16%
Consulting project report	12%
Class attendance (6%) and discussion (6%)	12%
Final exam	30%
Total----------	100%

Class Attendance and Discussion: The students are required to attend all classes and to submit their "learning share" via the Canvas Discussion. You share your feelings about math modeling with the entire class and me. Your learning share can be any feeling you have developed in the math model learning process, such as what you have learned, what math modeling power has impressed you and why, what practical problems you can use the learned model to solve, how is a certain model related to your other courses or your real world problems, what you like the best about a certain model, what are the difficulties when you learn a certain model or a method. Minimum ten (10) Discussion submissions are required for each student to earn the 6% credit. Each submission is limited to 80-300 words. Figures are welcome. Each figure is counted as 40 words. Other students and I can comment on your sharing, but the comments do not count toward the total ten.

A student has three chances to be absent without deduction from the 6% attendance credit. Each additional absence will lead to a deduction of 1%.

Computing: Students are required to bring a laptop computer to each class. Python will be the computer program used for this course and will be taught in class from the beginning. Python is free and can be downloaded and installed easily for either PC or Mac. Python code can be developed on Jupyter Notebook of Anaconda or Colab of Google. The Python code for the class can be downloaded from GitHub:
https://github.com/msayd99/Math_Modeling
YouTube Python tutorial can be found from
https://www.youtube.com/channel/UCtAKcMIg7_mNvifZUQxz_CQ/featured

Note-taking: Each student should build computer portfolio/folder for this class. The folder should include the pdf textbook, references, exam preparation materials, research project materials, R codes, and datasets. Students should take class notes either on paper or computer.

Learning outcome:

Upon completion of this course, students should be confident in their ability to use methods of calculus, linear algebra, statistics, and computer programming to formulate and solve climate science problems and present the corresponding quantitative solutions. In particular, students will be able to:

- Students are expected to master the basic concept of mathematical modeling in science and engineering.
- Develop and understand introductory mathematical models.
- Solve the models, either analytically or numerically, and visualize the modeling results by R code.
- Master basic principles of model sensitivity, model validation by observed data, and model revision for improvements.
- Interpret their math model and its results.
- Students will be able to write a mathematical modeling report for a specific problem with practical applications, with high quality tables, figures and visualization movies.
- Convey the mathematical model contributions from the people of color and understand the importance of equity, inclusion, and diversity.