

COURSE INFORMATION: Spring 2023
MATH 380 Introduction to Mathematical Modeling

Time and Place: 1:50pm-3:05pm, Tuesday & Thursday, at RE 121.

Instructor: Hemanshu Kaul, kaul@iit.edu.

Office: 125C, Rettaliata Engg Center.

Online Discussion: [Math 380 at Campuswire](#).

Office Hours: Tuesday and Thursday at 3:05-4pm. And by appointment in-person or through Zoom (send email to setup appointment).

Questions through Campuswire (above) are strongly encouraged.

TA Office Hours: Minshen Xu, Wednesday 12-3pm, at RE 129 or at [Math Tutoring Center](#).

Course Communications: [Course Webpage](#).

Check the course webpage regularly for homework assignments, announcements, and a lecture log (useful when you miss a class and when reviewing for an exam).

I often send emails with comments regarding HW problems, Exams, etc. Make sure your IIT email account is active and working.

Prerequisites: Calculus sequence must be completed (Math 151, 152, 251), Basic knowledge of Differential Equations (Math 252 can be taken simultaneously), Matrices & basic Linear Algebra (Math 332 can be taken simultaneously), knowledge of basic Probability, and knowledge of a computing environment like Mathematica/ Matlab, or any computer language like Python/Java/R.

Course Description: The primary aim of this course is to develop understanding of applied mathematics as a thought-process and a toolbox for the study of real-world phenomenon. It will focus on introducing concepts/tools from different parts of mathematics: continuous, discrete, and probabilistic - as they are applied to build and refine models for various applications. The secondary but equally important aim is the development of good habits of understanding, communicating, and writing mathematics: its tools as applied to a real-world problem, and the explicit as well as implicit assumptions underlying these mathematical models.

An official description of the lecture topics and the course objectives is available at

<https://www.iit.edu/applied-math/student-resources/course-syllabi>

Textbook: Giordano, Fox, Horton, *A First Course in Mathematical Modeling*, 5thed, Cengage, 2013.

Grade Break-down: (subject to change)

Homework and participation is worth 20%; Project is worth 30%, Two mid-term exams are worth 25% total; Final exam is worth 25%. The grading scale will be no more strict than A:90-100, B:77-89, C:66-76, D:55-65.

Weekly Schedule: On *Tuesday and Thursday* of each week, we will hold lectures and discussion in the classroom. On *Thursday* evening, a weekly HW, due a week later, will be uploaded to the course webpage. A lecture log and lecture notes will be available for review. This routine might be modified (as announced on the course webpage) before and after an exam.

Class Attendance and Participation: You are expected to attend all the lectures, and participate in the class discussions. You are also expected to read the textbook, including examples not covered in class, and review topics done in class.

Multiple absences from the Live Classroom without permission from instructor will result in deductions from your score at the discretion of the instructor.

Examinations: The exam dates and their precise topics will be announced on the course webpage. The final exam will be on all the topics covered during the semester. Make-up exams will be given only in case of a documented emergency.

Project: Students will do a project on a topic provided by the instructor by February 27th. Each project can be done by teams of 2 students. The final submission will consist of a project report and the related computer programs with data, due before April 29th. **Additional instructions and deadlines will be announced on the course webpage.**

Homework Assignment: Homework problems will be assigned once a week (typically on Thursday evening) which will be due one week later.

It is your responsibility to check the course webpage for assignments and their due dates. Homework needs to be submitted through the appropriate webpage on *Blackboard Assignment*. You will upload a single PDF file of your submission - either typed solutions (use LaTeX), or a scanned copy of your handwritten solutions.

HW solutions must be written following the rules described in the appropriately named section below. They must be written clearly, legibly, and concisely, and will be graded for both mathematical correctness and presentation.

HW Discussion Rules: You are allowed to discuss homework problems **only with your classmates, TA, and me**. However, the solutions should be written by you alone and, if you discussed HW problems with a classmate or TA, you have to **write their name at the top of the HW submission as a collaborator**. Any incident of plagiarism/ cheating (from a person or from any online resource) will be strictly dealt with according to University rules.

HW Solution Rules: Almost all problems that you encounter will have a modeling aspect to them, so you should **carefully follow and describe the process of modeling**: stating the primary underlying problem, stating and justifying your simplifying assumptions, formulating the model and its variables, solving or computing it, making conclusions from it, and validating it with real-data (if possible).

You are allowed the use of computational software, to aid in the basic computational work of the problems. In case of doubt, ask me for a clarification. But **you have to explain what you are doing in words**. **Its not enough to write down an equation without explaining how/why/what of it - you have to define what the variables mean. It is not acceptable to simply input data into Mathematica/Matlab/Python and ask it to figure out the “best model” for you. You can use these software to aid in your computations, not to simply solve the whole thing for you.** The use of computational software (Mathematica/Maple/Matlab/Python/Java/...) should be limited to that step of the solution which requires computation.

Most (or even all) of the solution of a problem should be written in words on paper (handwritten or typed). In your solution, you can refer to how you solved a equation or some such using whatever software you used, and give a short description as needed. The plots, computation tables, etc. can be directly taken from your computational software. Some students in the past have put together their solutions in MS WORD by typing the written response and combining it with cut-and-pasted computed portions/plots from Matlab, etc. A WORD file can easily be converted into a single PDF.

‘Why’ Homework? Homework serves as an opportunity for students to practice communicating written mathematics with clarity of thought and language. In a course like this, learning good communication skills in mathematics is very important. As significant is the opportunity that a homework provides you to test your understanding of the material covered in class that week. Mathematics cannot be learned by listening or just reading a book - you have to do it. Considering the varying pace of learning of students in class and the lack of class time to explore every detail of every concept/model, working through problems in the HW (both written and reading HWs) is

an easy way for you to make sure that you are keeping up with the class. This is why homework is given a lot of importance in this course - dedicate enough time to it every week.

To improve your mathematical writing quickly, start by writing draft solutions to the homework early. A day or two later after you have had time to forget what you wrote, read it. If it doesn't make sense or convince you, rewrite it. Writing a solution requires saying what you mean and meaning what you say. Be intellectually honest. Intellectual dishonesty includes: 1) stating a "reason" without understanding its relevance. 2) Claiming a conclusion when you know you haven't proved it. 3) Giving an example and claiming you have proved the statement for all instances. Include enough detail in your solutions so that your explanation is convincing to someone who hasn't thought about the problem before. The proofs/ arguments should be presented so that your classmates could read them and follow the logic (step-by-step).

Every homework will contain some straightforward exercises and a few slightly more challenging problems. Do not be disheartened if some problems take a while to solve. Such problems help develop your mathematical creativity. Discuss such problems with your classmates, and/ or ask me for help, but only after you have given them sufficient thought. Please remember that **homework is NOT meant to be an examination**, it is meant to assist in your learning and development. Unlike an exam, if you need help with a HW problem, don't hesitate to ask.

Ask for Help: You are encouraged to ask questions during the *Class*, through the *Campuswire Discussion Forums*, during the *Office Hours*, during the *TA office hours at Math Tutoring Center*, or through *Email to me*. If you are having trouble solving a homework problem, I will be glad to direct you in the right direction. The same goes for any reading in the book, or any concept you have difficulty understanding.

Don't hesitate to ask for help! I cannot help you if you don't take the initiative.

Accommodations through the Center for Disability Resources:

Reasonable accommodations will be made for students with documented disabilities. In order to receive accommodations, students must obtain a letter of accommodation from the Center for Disability Resources and email me to make an appointment to speak with me as soon as possible. See the [CDR website](#) for more details.

Illinois Tech's Sexual Harassment and Discrimination Information:

Sexual harassment, sexual misconduct, and gender discrimination by any member of the Illinois Tech community is prohibited. This includes harassment among students, staff, or faculty. Sexual harassment by a faculty member or teaching assistant of a student over whom they have authority or by a supervisor of a member of the faculty or staff is particularly serious. Such conduct may easily create an intimidating, hostile, or offensive environment.

Illinois Tech encourages anyone experiencing sexual harassment or sexual misconduct to speak with the Title IX Office for information on the resolution process and support options.

You can file a complaint [electronically](#), which may be completed anonymously. You may also file a complaint in-person by contacting the Title IX Coordinator, Virginia Foster at 312.567.5725/ foster@iit.edu or the Deputy Title IX Coordinator 312. 567.5726/ eespeland@iit.edu.

If you are not ready to file a formal complaint but wish to learn about your rights and options, you may contact Illinois Tech's Confidential Advisor service at 773.907.1062. You can also contact a licensed practitioner in Illinois Tech's Student Health and Wellness Center at 312.567.7550

For a comprehensive list of resources regarding counseling services, medical assistance, legal assistance and visa and immigration services, you can visit [the Title IX Office's website](#).