

SYLLABUS

FALL 2020

1. NUMBER and NAME: 11:375:303-NUMERICAL METHODS IN ENVIRONMENTAL SCIENCE

2. CREDITS AND CONTACT HOURS: 3 credits, 2-80 min. virtual lectures per week

Monday and Thursday, 10:55 – 12:15, online – ZOOM

3. INSTRUCTOR: Christopher Uchrin, Ph.D., P.E., F.ASCE, Physical Office: 262 ENR,

Virtual Office Hours: 10:00 am -10:55 am, Monday and Thursday at: cuchrin@rutgers.edu

4. COURSE RESOURCES AND MATERIALS:

a. Required Text: There is no required text for this course.

b. References: Beginning Statistics, Schaum's Outline Series

Applied Numerical Methods with MATLAB, Steven C. Chapra

Req'd. Resource: Scientific calculator with statistical functions or laptop PC

5. SPECIFIC COURSE INFORMATION

Catalog Description: *Formulation and solution of environmental science problems by applying analytical and numerical techniques. Principles of data analysis. Generation and solution of mass and energy balances.*

6. COURSE GOALS:

a. Specific instructional outcomes: Students will be versed in formulating and solving environmental science and engineering problems by applying numerical and statistical tools and techniques. Student problem-solving skills will be enhanced through the use of homework projects involving the employment of considerable analytical skills. Students will be versed in ethical issues, particularly involving data generation, reporting and analysis.

b. The Environmental Science Undergraduate Program learning goals addressed in this course are:

1. apply knowledge skills and techniques from the sciences and mathematics to identify, characterize and provide solutions for environmental problems;

2. design and conduct experiments, analyze and interpret data to draw informed conclusions;

5. recognize and discuss ethical and professional responsibilities of environmental scientists in addressing contemporary environmental science issues and the impact of environmental science in a global and societal context;

7. PRELIMINARY COURSE SCHEDULE:

(Subject to change; check CANVAS for updates)

Lecture	Topic	(Reference)
1	Introduction, Frequency Distributions in One Variable	(Schaum Ch. 1 & 2)
2-3	Central Tendency Measures, Dispersion, Outliers	(Schaum Ch. 3 & 4)
4	Professionalism and Ethics	(CU Notes)
5	Hypotheses, Comparison of Means, t-test	(Schaum Ch. 9 & 10)
6	Analysis of Variance (ANOVA), F-test	(Schaum Ch. 12)
7	Chi-Square	(Schaum Ch. 11)
8	Elementary Linear Regression; Correlation	(Schaum Ch. 13)
9-11	Linear Transformations of Zero- and First-Order Reaction Rate Equations, Rate Limiting Functions (Langmuir Isotherm Example) and Power Functions (Freundlich Isotherm Example)	
12	Multiple Linear Regression	(Chapra Ch. 15.2)
13	Exam 1	
14	Numerical Solution of non-Linear Algebraic Equations	(Chapra Ch. 6)
15	Linear Algebraic Equations and Matrices	(Chapra Ch.8)
16-18	Matrix Inversion; Application to Multiple Linear Regression and Finite Section Water Quality Mass Balance Models	(Chapra Ch. 11)
19-22	Solution of Differential Equations Using Euler's Method with application to Flood Routing Mass Balance Hydrologic Model	(Chapra Ch. 22)
23-24	Fourier Series Analysis with Application to Periodic Step Function	(Chapra Ch. 16; Lecture)
25-27	Environmental Engineering Economics; Cost/Benefit Analysis	(Lecture Notes)
Exam 2	TBA	

8. GRADING & ASSESSMENT:

Student learning will be assessed and final grades weighted as follows:

10 Homework Assignments 40%

2 Exams (non-cumulative) 60%

The lowest homework grade will be dropped. Homework assignments will be graded and discussed briefly in class approximately one week after the due date. There will **be no late assignments or exam makeups accepted unless you have an Absence Verification Letter signed by the Dean of Students Office for an emergency absence (i.e. illness, personal or family emergency, etc.).**

FINAL EXAM Online Final exam Schedule: <http://finalexams.rutgers.edu/>

ACCOMODATIONS FOR STUDENTS WITH DISABILITIES Please follow the procedures outlined at <https://ods.rutgers.edu/students/registration-form>. Full policies and procedures are at <https://ods.rutgers.edu/>

ABSENCE POLICY

Students are expected to attend all classes; if you expect to miss one or two classes, please use the University absence reporting website <https://sims.rutgers.edu/ssra/> to indicate the date and reason for your absence. An email is automatically sent to me.

ACADEMIC INTEGRITY

I expect that every student will adhere to the strictest principles of academic integrity. Cheating on tests or homework deprives you of the educational benefits of preparing these materials appropriately. It is not only personally dishonest but also unfair, since it gives you an undeserved advantage over your fellow students who are graded on the basis of their own work. I take cheating very seriously and all suspected cases of cheating will be automatically referred to the Office of Judicial Affairs with recommend penalties appropriate to the gravity of the infraction.

The university's policy on Academic Integrity is available at <http://academicintegrity.rutgers.edu/academic-integrity-policy>. The principles of academic integrity require that a student:

- properly acknowledge and cite all use of the ideas, results, or words of others.
- properly acknowledge all contributors to a given piece of work.
- make sure that all work submitted as his or her own in a course or other academic activity is produced without the aid of impermissible materials or impermissible collaboration.
- obtain all data or results by ethical means and report them accurately without suppressing any results inconsistent with his or her interpretation or conclusions.

- treat all other students in an ethical manner, respecting their integrity and right to pursue their educational goals without interference. This requires that a student neither facilitate academic dishonesty by others nor obstruct their academic progress.

- uphold the canons of the ethical or professional code of the profession for which he or she is preparing.

Adherence to these principles is necessary in order to ensure that

- everyone is given proper credit for his or her ideas, words, results, and other scholarly accomplishments.

- all student work is fairly evaluated and no student has an inappropriate advantage over others.

- the academic and ethical development of all students is fostered.

- the reputation of the University for integrity in its teaching, research, and scholarship is maintained and enhanced.

Failure to uphold these principles of academic integrity threatens both the reputation of the University and the value of the degrees awarded to its students. Every member of the University community therefore bears a responsibility for ensuring that the highest standards of academic integrity are upheld.

STUDENT WELLNESS SERVICES

Counseling, ADAP & Psychiatric Services (CAPS) (848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901/
www.rhscaps.rutgers.edu/

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professional within Rutgers Health services to support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include: individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

Violence Prevention & Victim Assistance (VPVA) (848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901
[/ www.vpva.rutgers.edu/](http://www.vpva.rutgers.edu/)

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

Disability Services

(848) 445-6800 / Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854 / <https://ods.rutgers.edu/>

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the

appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>.

Scarlet Listeners (732) 247-5555 / <https://rutgers.campuslabs.com/engage/organization/scarletlisteners>

Free and confidential peer counseling and referral hotline, providing a comforting and supportive safe space.

Prepared by Christopher G. Uchirin 8/26/2020