Syllabus - Introduction to Environmental Informatics
GSEI 2070 (Spring 2023)

1. **Course Title**: Introduction Environmental Informatics

2. **Credit Hours/Prerequisites**: 3 Credit hours – 2 hours lecture (2); 1 hours lab (1)
   Prerequisite: GSEI 1200 Digital Earth or Instructor Approval

3. **Instructor:** Dr. Sanjiv Kumar, Assistant Professor, School of Forestry and Wildlife Sciences, Email: szk0139@auburn.edu

4. **When and Where:** TR: 9.30 am to 10.45 am;
   R 11.00 am to 12.15 pm
   FORY 2208

5. **Office hours** By appointment

6. **Texts or Major Resources:**

   - Please check the canvas regularly. The instructor will upload relevant course material on canvas.

   - Grus, Joel (2019). Data Science from Scratch, O'Reilly Media, Inc., Second Edition, E-book available from AU Library.

7. **Course Description:**

A sophomore-level course is open to undergraduate students in geospatial and environmental informatics (GSEI), natural resource management, forestry, agricultural, crop, and environmental sciences, geoscience, civil engineering, biosystem engineering-related fields. This course will provide hands-on experience applying information science to environmental data management. The characteristics of spatial, temporal, and complex environmental systems will be presented. Environmental data science in natural resource management and decision-making will be discussed. Students will gain expertise in collecting, collating, archiving, modeling, analyzing, visualizing, and communicating information in natural resource management.

8. **Course Objectives:**

Having completed this course, the student will be able to:

- Describe the role of information science in natural resource management.
- Demonstrate basic proficiency in data management challenges, including metadata, discovery, citation, archiving, and formats.
- Explain the use of spatially-defined, multi-layered, multi-scale data for environmental characterization and modeling.
- Perform basic quantitative models for common environmental problems.

- Describe the role and components of decision science for environmental management.
- Describe the various roles of quantitative analysis for environmental informatics.
- Discuss the challenges of complex environmental problems facing today's society and the role of environmental informatics in society's response to these problems.

9. Grading:

Exams will be based on readings, class lecture notes, and lab exercises. The final exam will be comprehensive.

Final Exam	30% (15% written, 15% lab)
Mid-term	30% (15% written, 15% lab)
Homework and Quizzes	40% (homework)

Final grades will be based on a 90-80-70-60 scale, but the instructor reserves the right to curve up.

10. Course policies

- **Please refer to the university guidelines for COVID related policy**

Attendance: Students are expected to attend all classes and be held responsible for any content covered in the event of an absence.

Excused Absences: Students are granted excused absences from class for the following reasons: illness of the student or serious illness of a member of the student's immediate family, the death of a member of the student's immediate family, trips for student organizations sponsored by an academic unit, trips for university classes, trips for participation in intercollegiate athletic events, subpoena for a court appearance, and religious holidays. Students who wish to have an excused absence from class for any other reason must contact the instructor to request permission in advance of the absence. The instructor will weigh the merits of the request and render a decision. When feasible, the student must notify the instructor prior to any excused absences, but in no case shall such notification occur more than one week after the absence. Appropriate documentation for all excused absences is required. Please consult the *Student Policy* eHandbook for more information on excused absences.

Make-Up Policy: Arrangement to make up a missed major examination (e.g., hour exams, mid-term exams) due to properly authorized the student must initiate excused absences within one week of the end of the period of the excused absence(s). Except in unusual circumstances, such as the continued absence of the student or the advent of university holidays, a make-up exam will take place within two weeks of the date that the student initiates arrangements for it. Except in extraordinary circumstances, no make-up exams will be arranged during the last three days before the final exam period begins.

Academic Honesty Policy: All portions of the Auburn University student academic honesty code (Title XII) found in the Student Policy eHandbook will apply to university courses. All academic honesty violations or alleged violations of the SGA Code of Laws will

be reported to the Office of the Provost, which will then refer the case to the Academic Honesty Committee.

Disability Accommodations: Students who need accommodations are asked to submit their approved accommodations through AU Access electronically and to arrange a meeting during office hours the first week of classes or as soon as possible if accommodations are needed immediately. If your schedule conflict with my office hours, an alternate time can be arranged. To set up this meeting, please contact me by email. If you have not established accommodations through the Office of Accessibility, but need accommodations, make an appointment with the Office of Accessibility, 1228 Haley Center, 844-2096 (V/TT).

11. Course Schedule

GSEI 2070, Spring 2023		
Week 1	**Defining Environmental Informatics**	
	Lecture 1.1	Introduction to Environmental Informatics (EI) – Part 1
	Lab 1	Python Tutorial – (A crash course in Python – I)
	Homework 1	Reading Assignment about the Environmental Data Science (Gilbert et al., 2018)
Week 2	**Environmental Data**	
	Lecture 2.1	Introduction to EI – Part 2
	Lecture 2.2	Environmental Data
	Lab 2	Python Tutorial 2: Visualizing the data
	Homework 2	Follow-up from Lab 2
Week 3	**Environmental Data Analysis - I**	
	Lecture 3.1	Statistical Methods – Part 1
	Lecture 3.2	
	Lab 3	Python Tutorial 3: Statistics
	Homework 3	Follow-up from Lab3
Week 4	**Environmental Data Analysis - II**	
	Lecture 4.1	Statistical Methods – Part 2
	Lecture 4.2	
	Lab 4	Python Tutorial 4: Probability
	Homework 4	Follow-up from Lab 4
Week 5	**Environmental Data Analysis - III**	
	Lecture 5.1	Statistical Methods – Part 3
	Lecture 5.2	
	Lab 5	Python Tutorial 5: Hypothesis and Inference
	Homework	Follow-up from Lab 5
Week 6	**Database Management System**	
	Lecture 6.1	Environmental Database
	Lecture 6.2	Structured Query Language

	Lab 6	Python Tutorial 6: Database and SQL
	Homework 6	Follow-up from Lab 6
Week 7	**Special topic in environmental data analysis**	
	Lecture 7.1	Water Data for the nation
	Lecture 7.2	Defining streamflow characteristics and human management
	Lab 7	Python Tutorial 7: Getting Data
	Homework 7	Follow-up from Lab 7
Week 8	**Midterm Exam**	
	Lecture 8.1	Review for the midterm exam
	Lecture 8.2	Midterm exam - written
	Lab 8	Midterm exam - lab
	Homework 8	Take home part of the lab exam (if any)
Week 9	**High-Performance Computing**	
	Lecture 9.1	Special Topics in Environmental Data Science
	Lecture 9.2	An Introduction to Supercomputer (Guest Lecture by HPC Admin)
	Lab 9	
	Homework 2	
Week 10	**Big Data in Environmental Science**	
	Lecture 10.1	Big Data in Environmental Science
	Lecture 10.2	Multidimensional Data
	Lab 10	Python Tutorial 8: Working with the data I
	Homework 10	Follow-up from Lab 10
Week 11	**Environment Decision Making**	
	Lecture 11.1	Decision Support System (DSS)
	Lecture 11.2	DSS – A case study
	Lab 11	Python Tutorial – 9: Working with data II
	Homework 11	Follow-up from Lab 11
Week 12	**Remote Sensing of the Environment**	
	Lecture 12.1	Remote Sensing – Basic Principle
	Lecture 12.1	Remotely Sensed Vegetation Data
	Lab 12	Python Tutorial 10: Working with MODIS data
	Homework 12	Follow-up from Lab 12
Week 13	**Environmental Modeling - I**	
	Lecture 13.1	Numerical modeling of the environmental system
	Lecture 13.1	Modeling concepts – physical versus empirical models, distributed versus lumped models
	Lab 13	Python Tutorial 11 – Simple Linear Regression Model
	Homework 13	Follow-up from Lab 13
Week 14	**Environmental Modeling - II**	
	Lecture 14.1	Time Series Analysis

	Lecture 14.2	Assessment of changing water availability, flood, and Drought
	Lab 14	Python Tutorial 11: Trend Analysis in Python
	Homework 14	Follow up from Lab 14
Week 15	**Future Trends/New Developments**	
	Lecture 15.1	Citizen Science
	Lecture 15.2	Machine learning
	Lab 14	Python Tutorial 12: Machine Learning
	Homework 15	Follow-up from Lab 14
Week 16	**Final Exam**	
	Lecture 16.1	Review for final exam
	Lecture 16.2	The written part of the final exam
	Lab 16	The lab part of final exam

Each homework is due the following week by Friday 5 pm.