CUNY Common Core
Course Submission Form

Instructions: All courses submitted for the Common Core must be liberal arts courses. Courses may be submitted for only one area of the Common Core and must be 3 credits. STEM waiver courses do not need to be approved by the Common Core Course Review Committee. The form should not be used for STEM waiver courses.

College	Lehman College
Course Prefix and Number (e.g., ANTH 101, if number not assigned, enter XXX)	GEO 170
Course Title	Earth Science and Society
Department(s)	Earth, Environmental and Geospatial Science
Discipline	Earth Science
Credits	3
Contact Hours	3
Pre-requisites (if none, enter N/A)	N/A
Co-requisites (if none, enter N/A)	N/A
Catalogue Description	Structures and interactions between four main Earth layers: lithosphere, hydrosphere, atmosphere, biosphere and lithosphere in the context of societal activities.
Special Features (e.g., linked courses)	
Sample Syllabus	Syllabus must be included with submission

Indicate the status of this course being nominated:

☒ current course ☐ revision of current course ☐ a new course being proposed

CUNY COMMON CORE Location

Please check below the area of the Common Core for which the course is being submitted. (Select only one.)

Required

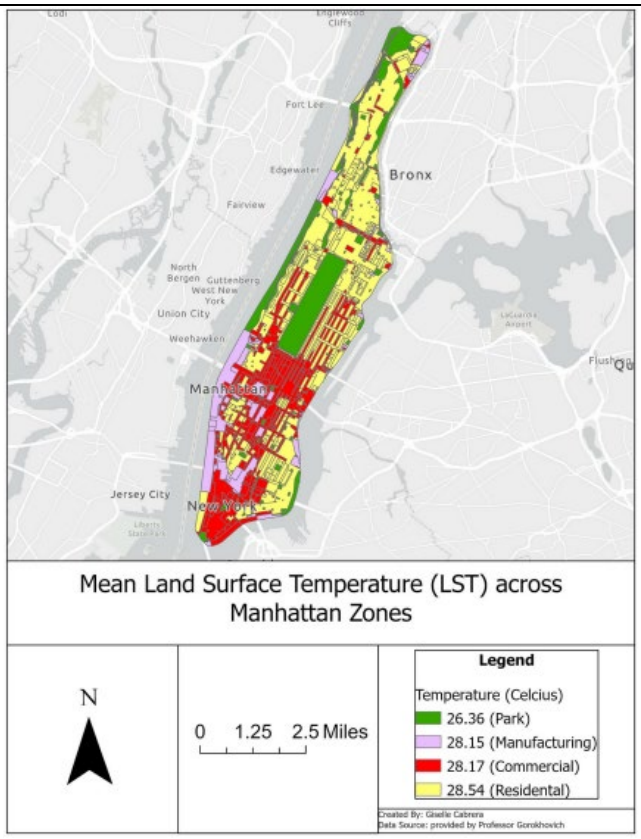
- ☐ English Composition
- ☐ Mathematical and Quantitative Reasoning
- ☒ Life and Physical Sciences

Flexible

- ☐ World Cultures and Global Issues
- ☐ US Experience in its Diversity
- ☐ Creative Expression
- ☐ Individual and Society
- ☐ Scientific World

Learning Outcomes **In the left column explain the course assignments and activities that will address the learning outcomes in the right column.**	
I. Required Core (12 credits)	
A. English Composition: Six credits A course in this area must meet all the learning outcomes in the right column. A student will:	
	• Read and listen critically and analytically, including identifying an argument's major assumptions and assertions and evaluating its supporting evidence.
	• Write clearly and coherently in varied, academic formats (such as formal essays, research papers, and reports) using standard English and appropriate technology to critique and improve one's own and others' texts.
	• Demonstrate research skills using appropriate technology, including gathering, evaluating, and synthesizing primary and secondary sources.
	• Support a thesis with well-reasoned arguments, and communicate persuasively across a variety of contexts, purposes, audiences, and media.
	• Formulate original ideas and relate them to the ideas of others by employing the conventions of ethical attribution and citation.
B. Mathematical and Quantitative Reasoning: Three credits A course in this area must meet all the learning outcomes in the right column. A student will:	
	• Interpret and draw appropriate inferences from quantitative representations, such as formulas, graphs, or tables.
	• Use algebraic, numerical, graphical, or statistical methods to draw accurate conclusions and solve mathematical problems.
	• Represent quantitative problems expressed in natural language in a suitable mathematical format.
	• Effectively communicate quantitative analysis or solutions to mathematical problems in written or oral form.
	• Evaluate solutions to problems for reasonableness using a variety of means, including informed estimation.
	• Apply mathematical methods to problems in other fields of study.

C. Life and Physical Sciences: Three credits A course in this area must meet all the learning outcomes in the right column. A student will:	
Students will learn fundamental concepts of Earth Science postulating the interconnectedness between Earth System elements such as hydrosphere, lithosphere, atmosphere and biosphere. This interconnectedness is a basis for our understanding of the link between society and planet Earth. **Students will, for example, review historical works of Alexander von Humboldt (1769 – 1859) and Vladimir Vernadsky (1863–1945) who were the first among other scientists who noticed and described the connection between earth system elements. In addition, students will be introduced to scientific method and methodology of the short- and long term of measurements in Earth Science.** **Students will have to complete weekly quizzes. Here is an example of the assessment using multiple choice:** **Question: Which one relates to scientific method?** **Potential Answers:** **1. series of steps** **2. lab analysis - statistical analysis** **3. statistical analysis** **4. mathematical algorithm** **Homework assignment example: students will be provided with a map (data) showing various mean surface temperatures in Manhattan, measured by satellite Landsat; it also includes a legend explaining various land surface covers (e.g. residential area, park, etc.).**	● Identify and apply the fundamental concepts and methods of a life or physical science.



Using this data on the map students should apply scientific method to investigate the association between land surface temperature and land cover. The written assignment should include the following sections:

1. Observation (from the map)

In this section students should write observation from the data depicted on the map. Here is an example of such answer:

"My observation of the map is that the land surface temperature is lower in the park and higher in other areas in Manhattan where is manufacturing, residential and commercial areas are. Upon comparison of temperature values, I see that in parks temperature is lower by approximately 2 degrees Celsius."

2. Question

After observing the surface temperature distribution in Manhattan students should formulate a scientific question. Here is an example of the answer:

"The question that I pose is: Why park areas have lower surface temperature than other areas?"

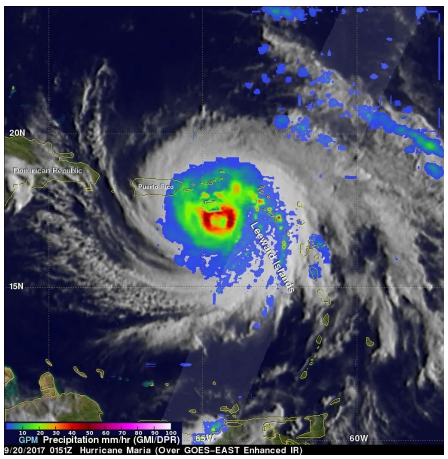
3. Hypothesis

In this section students formulate a hypothesis. For example:

"My hypothesis is that in parks we have more vegetation than in areas

of residential, manufacturing and commercial activities; vegetation absorbs less heat, therefore the surface temperature is lower" OR "My hypothesis is that in parks we have fewer concrete surfaces; concrete absorbs and retains more heat from the sun, therefore the surface temperature in concrete surfaces is higher than in parks." **4. Experimental design (variables)** **Following lecture materials students should write an experimental setting and define which variable is depending and which is independent. For example:** **My experiment will consist of the following: I need to measure and compare heat absorption in vegetation and concrete. My dependent variable is heat absorption and my independent variable is a material type, i.e. vegetation and cement or various land cover surfaces, such as forest (vegetation), commercial areas (concrete), etc."** **5. Data collection (methods)** **Since students are not able to collect field data or work with remote sensing data they can use literature search to find comparison between heat absorption in concrete and vegetation from at least three sources. They can use Google Scholar or Scopus and provide references for their findings. The idea of literature search to find data from other scientists when we are not able to conduct experiment by ourselves will also be highlighted in lecture material.** **6. Analysis** **Using collected data students should write analytical part of the written assignment. For example: "Analysis of data from (Reference list) shows that measured heat absorption of the concrete is higher than vegetation by (they will indicate %)".** **7. Conclusion** **In this section students will write conclusion, for example: "Using three independent research data on heat absorption in concrete and vegetation we conclude that the concrete has higher heat absorption rate than vegetation. This leads to the higher surface temperature in park areas and lower surface temperature in commercial and residential areas. This finding might be useful in urban planning to reduce "heat island" effect in cities."**	
Students will assess the performance of scientific method in key discoveries related to all four elements of the Earth System, i.e. hydrosphere, litosphere, atmosphere and biosphere. **Students will, for example, review the discovery of the continental drift in 1913 and plate tectonics in 1970s (lithosphere) as well as origin of life (biosphere) from inorganic matter. In relation to connection between lithosphere and biosphere students will be introduced to the famous hypothesis by Vernadsky who staged series of experiments to prove it. This experimentation not only demonstrated the connection between lithosphere and biosphere but also provided a foundation for endemic**	• Apply the scientific method to explore natural phenomena, including hypothesis development, observation, experimentation, measurement, data analysis, and data presentation.

disease studies. **Students will have to complete weekly quizzes, 20 min each. Here is an example of the assessment using multiple choice:** **Question: which brief explanation reflects the essence of Vernadsky's experiment?** **Potential Answers:** **1. Geochemistry of soils** **2. We are what we eat** **3. Organic matters** **4. Healthy body, healthy soul** **Homework assignment: students will write a brief essay to distinguish between global measurements in four spheres of the Earth.**	
Students will use open data portals and tools from the National Aeronautics and Space Administration (NASA) and National Oceanic and Atmospheric Administration (NOAA) as well as other agencies to learn about current investigations and discoveries in Earth Science. **Students will, for example, use NASA portal Giovanni to observe changes in atmosphere, biosphere and hydrosphere; for more traditional investigation they will download several data sets related to long-term climate change and conduct investigations using statistical tools.** **Students will have to complete weekly quizzes, 20 min each. Here is an example of the assessment using multiple choice:** **Question: what is the main element in recent discovery connecting water origin on Earth and magma composition?** **Potential Answers:** **1. Olivine** **2. Granit** **3. Ringwoodite** **4. Stromatolite** **Homework assignment: students will use free NASA software Panoply to visualize global rainfall distribution for a selected day.**	● Use the tools of a scientific discipline to carry out collaborative laboratory investigations.
Students will use data visualization tools from NASA, NOAA and other portals linked to real data measurements to produce maps and charts. They will learn various statistical methods to interpret data and mapping techniques to visualize them. **Students will, for example, gather data on wind and precipitation from NASA portal and conduct interpretation of hurricane activity in the region currently experiencing hurricane.** **Students will have to complete weekly quizzes, 20 min each. Here is an example of the assessment using multiple choice:**	● Gather, analyze, and interpret data and present it in an effective written laboratory or fieldwork report.

Question: why hurricane patterns are different in the northern and southern hemispheres? **Potential Answers:** 1. **Visualization error** 2. **Coriolis force** 3. **Gravity force** 4. **Prevailing wind direction** **<u>Homework assignment:</u> students will use free NASA software Panoply to visualize propagation of the hurricane Helene, 2024, using three time stamps: approach to the North Carolina coast, landfall and dissipation. Upon successful visualization students will analyze hurricane movement and precipitation.** **The visualization is a map showing hurricane rotation and precipitation levels. Here is an example showing a different hurricane at a specific time stamp:**  **Description of the anticipated homework and lab report structure:** **1. Gathering data: download data from NASA web site, open in Panoply and select a variable for visualization (i.e. precipitation), map coordinate system and spatial extent.** **2. Analyze: read precipitation scale and make observation about its rate (min/max) and spatial distribution across hurricane pattern (i.e. where do you see max and where min rates).** **3. Interpreting: in which direction hurricane moves and rotates? Why? How does precipitation changes with hurricane propagation from the coast to the land? What causes this change?**	
Students will learn about peer-reviewed method in science and the difference between data sources and publication outlets. They will review historic cases that involve controversial methodologies and data sources. **For example, climate change is one of the highly debatable issues in scientific ethics and data reporting and assessment. Just one example is a "hockey stick" chart presented to scientific community to explain**	• Identify and apply research ethics and unbiased assessment in gathering and reporting scientific data.

increase of mean temperature record of the past 500 to 2000 years. This specific topic involves understanding of the so-called "climate proxies". Students will be introduced to various aspects of critical review of data and publications on the topic.

Students will have to complete weekly quizzes, 20 min each. Here is an example of the assessment using multiple choice:

Question: which element of scientific process eliminates conspiracy or often controversial theories in Earth Science?

Potential Answers:

1. **High quotation in journals**
2. **Methodology is approved by few high experts in the field**
3. **The results of the discovery match expectations of scientific team**
4. **Method is repeatable by various scientists**

<u>Homework assignment:</u>

I. Compile list of violations of research ethics and unbiased assessment by analyzing reasons for retraction of research papers from earth science journals.

1. **Visit site Retraction Watch at: https://retractionwatch.com/**
2. **Scroll down to Retraction Watch Database and click View the Database**
3. **Download file retraction_watch.csv and save to the hard drive.**
4. **Open the file in Excel**
5. **Go to Data and click Filter; you should see in the upper row multiple black triangles at the right side of the column title.**
6. **Find column "Subject", click black triangle and choose filter: (ENV) Environmental Sciences;(PHY) Geology**
7. **Find column "Article Type", click the black triangle and choose filter: Research Article.**
8. **Look at the columns "Reason" and list all unique occurrences of the reason for retracting the paper.**
9. **Calculate number of selected retractions in the database.**
10. **What are three most frequent ethical/research violations?**

II. Analyze and interpret the impact of retractions on scientific community

1. **On the main page click "Top 10 most highly cited retracted papers"**
2. **Look at the column "Citing Articles before retraction"; it shows number of citations since article was published, before its retraction.**
3. **What is your conclusion about the significance of these citations of retracted paper for scientific community?**

III. Discuss the potential violations of research ethics and unbiased assessment in cases of private and governmental funding. Specifically, what can cause these violations? Can we abstain of these violations? How?

II. Flexible Core (18 credits) Six three-credit liberal arts and sciences courses, with at least one course from each of the following five areas and no more than two courses in any discipline or interdisciplinary field.	
A. World Cultures and Global Issues	
A Flexible Core course must meet the three learning outcomes in the right column.	
	• Gather, interpret, and assess information from a variety of sources and points of view.
	• Evaluate evidence and arguments critically or analytically.
	• Produce well-reasoned written or oral arguments using evidence to support conclusions.
A course in this area (II.A) must meet at least three of the additional learning outcomes in the right column. A student will:	
	• Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring world cultures or global issues, including, but not limited to, anthropology, communications, cultural studies, economics, ethnic studies, foreign languages (building upon previous language acquisition), geography, history, political science, sociology, and world literature.
	• Analyze culture, globalization, or global cultural diversity, and describe an event or process from more than one point of view.
	• Analyze the historical development of one or more non-U.S. societies.
	• Analyze the significance of one or more major movements that have shaped the world's societies.
	• Analyze and discuss the role that race, ethnicity, class, gender, language, sexual orientation, belief, or other forms of social differentiation play in world cultures or societies.
	• Speak, read, and write a language other than English, and use that language to respond to cultures other than one's own.

B. U.S. Experience in its Diversity A Flexible Core course must meet the three learning outcomes in the right column.	
	• Gather, interpret, and assess information from a variety of sources and points of view.
	• Evaluate evidence and arguments critically or analytically.
	• Produce well-reasoned written or oral arguments using evidence to support conclusions.
A course in this area (II.B) must meet at least three of the additional learning outcomes in the right column. A student will:	
	• Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring the U.S. experience in its diversity, including, but not limited to, anthropology, communications, cultural studies, economics, history, political science, psychology, public affairs, sociology, and U.S. literature.
	• Analyze and explain one or more major themes of U.S. history from more than one informed perspective.
	• Evaluate how indigenous populations, slavery, or immigration have shaped the development of the United States.
	• Explain and evaluate the role of the United States in international relations.
	• Identify and differentiate among the legislative, judicial, and executive branches of government and analyze their influence on the development of U.S. democracy.
	• Analyze and discuss common institutions or patterns of life in contemporary U.S. society and how they influence, or are influenced by, race, ethnicity, class, gender, sexual orientation, belief, or other forms of social differentiation.
C. Creative Expression	
A Flexible Core course must meet the three learning outcomes in the right column.	
	• Gather, interpret, and assess information from a variety of sources and points of view.
	• Evaluate evidence and arguments critically or analytically.
	• Produce well-reasoned written or oral arguments using evidence to support conclusions.
A course in this area (II.C) must meet at least three of the additional learning outcomes in the right column. A student will:	
	• Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring creative expression, including, but not limited to, arts, communications, creative writing, media arts, music, and theater.
	• Analyze how arts from diverse cultures of the past serve as a foundation for those of the present, and describe the significance of works of art in the societies that created them.
	• Articulate how meaning is created in the arts or communications and how experience is interpreted and conveyed.
	• Demonstrate knowledge of the skills involved in the creative process.
	• Use appropriate technologies to conduct research and to communicate.

D. Individual and Society A Flexible Core course must meet the three learning outcomes in the right column.	
	• Gather, interpret, and assess information from a variety of sources and points of view.
	• Evaluate evidence and arguments critically or analytically.
	• Produce well-reasoned written or oral arguments using evidence to support conclusions.
A course in this area (II.D) must meet at least three of the additional learning outcomes in the right column. A student will:	
	• Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring the relationship between the individual and society, including, but not limited to, anthropology, communications, cultural studies, history, journalism, philosophy, political science, psychology, public affairs, religion, and sociology.
	• Examine how an individual's place in society affects experiences, values, or choices.
	• Articulate and assess ethical views and their underlying premises.
	• Articulate ethical uses of data and other information resources to respond to problems and questions.
	• Identify and engage with local, national, or global trends or ideologies, and analyze their impact on individual or collective decision-making.
E. Scientific World A Flexible Core course must meet the three learning outcomes in the right column.	
	• Gather, interpret, and assess information from a variety of sources and points of view.
	• Evaluate evidence and arguments critically or analytically.
	• Produce well-reasoned written or oral arguments using evidence to support conclusions.
A course in this area (II.E) must meet at least three of the additional learning outcomes in the right column. A student will:	
	• Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring the scientific world, including, but not limited to: computer science, history of science, life and physical sciences, linguistics, logic, mathematics, psychology, statistics, and technology-related studies.
	• Demonstrate how tools of science, mathematics, technology, or formal analysis can be used to analyze problems and develop solutions.
	• Articulate and evaluate the empirical evidence supporting a scientific or formal theory.
	• Articulate and evaluate the impact of technologies and scientific discoveries on the contemporary world, such as issues of personal privacy, security, or ethical responsibilities.
	• Understand the scientific principles underlying matters of policy or public concern in which science plays a role.