COURSE DESCRIPTION:

Through the exploration of cause and effect, the course investigates how values interact with choices and actions, resulting in a range of environmental impacts. Students develop an understanding that the connections between environmental systems and societies are diverse, varied and dynamic. The complexity of these interactions challenges those working towards understanding the actions required for effective guardianship of the planet and sustainable and equitable use of shared resources.

ESS is a complex course, requiring a diverse set of skills from its students. It is firmly grounded in both a scientific exploration of environmental systems in their structure and function and in the exploration of cultural, economic, ethical, political, and social interactions of societies with the environment. As a result of studying this course, students will become equipped with the ability to recognize and evaluate the impact of our complex system of societies on the natural world. The interdisciplinary nature of the course requires a broad skill set from students and includes the ability to perform research and investigations and to participate in philosophical discussion. The course requires a systems approach to environmental understanding and problem solving, and promotes holistic thinking about environmental issues. It is recognized that to understand the environmental issues of the 21st century and suggest suitable management solutions, both the human and environmental aspects must be understood. Students should be encouraged to develop solutions from a personal, to a community, and to a global scale.

GENERAL GOALS/ESSENTIAL QUESTIONS:

The primary goal of Environmental Systems and Societies is to encourage a holistic perspective on the relationship between environmental systems and the impact of human societies. And in doing so, prepare students to take the IB exams at the end of their senior year through the investigation of different atmospheric, terrestrial, and aquatic systems where students will identify the strengths and limitations of their system models, investigate environmental impact and recovery, assess and compare personal value systems, identify the sustainability of solutions, and reflect upon their predictions for the future of human societies and the biosphere.
CCSS READING COMPONENT:

Students will read from various text sources including science texts, science journals, science news articles, and a variety of science web materials. Students will cite strong and thorough textual evidence to support analysis of what the text says. Students will integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively), as well as in words in order to address scientific questions or solve scientific problems. Students will gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism. Students will draw evidence from literary and/or informational texts to support analysis, reflection, and research on a variety of scientific topics.

CCSS WRITING COMPONENT:

Students will complete investigations that are complex and commensurate with the level of the IB Environmental Systems SL course. These will require a purposeful research question and scientific rationale. Students will write thorough lab reports with a detailed background, methodology, analysis, and conclusion. During the course, students will complete writing assignments and other investigations where students will state scientific claims and support them with evidence.

CCSS SPEAKING AND LISTENING COMPONENTS:

Students will initiate and participate effectively in collaborative discussions including one-on-one, in groups, and teacher led. Students engage in peer teaching, presentations of research findings, and class discussions.

In this course students will complete independent investigations. Students will complete a collaborative project with students in other Group 4 sciences course investigating a scientific or technological problem where students will plan, implement, and evaluate the project.

DETAILED UNITS OF INSTRUCTION:

This course will cover the 8 core topics, and a practical scheme of work element that is fully integrated within the class to provide students with lab and research experiences directly related to the core topics, and designed to prepare the student for the internal assessment task which involves the completion of an individual investigation of an ESS research question that has been designed and implemented by the student.

Core Topics: Recommended Hours

**Topic 1: Foundations of environmental systems and societies: 16 Hours**

1.1 Environmental value systems  
1.2 Systems and models  
1.3 Energy and equilibria  
1.4 Sustainability  
1.5 Humans and pollution  

**Topic 2: Ecosystems and ecology: 25 Hours**  
2.1 Species and populations
2.2 Communities and ecosystems
2.3 Flows of energy and matter
2.4 Biomes, zonation and succession
2.5 Investigating ecosystems

**Topic 3: Biodiversity and conservation: 13 Hours**
3.1 An introduction to biodiversity
3.2 Origins of biodiversity
3.3 Threats to biodiversity
3.4 Conservation of biodiversity

**Topic 4: Water and aquatic food production systems and societies: 15 Hours**
4.1 Introduction to water systems
4.2 Access to fresh water
4.3 Aquatic food production systems
4.4 Water pollution

**Topic 5: Soil systems and terrestrial food production systems and societies: 12 Hours**
5.1 Introduction to soil systems
5.2 Terrestrial food production systems and food choices
5.3 Soil degradation and conservation

**Topic 6: Atmospheric systems and societies 10 Hours**
6.1 Introduction to the atmosphere
6.2 Stratospheric ozone
6.3 Photochemical smog
6.4 Acid deposition

**Topic 7: Climate change and energy production: 13 Hours**
7.1 Energy choices and security
7.2 Climate change—causes and impacts
7.3 Climate change—mitigation and adaptation

**Topic 8: Human systems and resource use: 16 Hours**
8.1 Human population dynamics
8.2 Resource use in society
8.3 Solid domestic waste
8.4 Human population carrying capacity

**Practical Scheme of Work: 30 hours**
Practical activities
Individual investigation

**Total teaching hours 150**

**TEXTBOOKS AND RESOURCE MATERIALS:**
SUBJECT AREA CONTENT STANDARDS TO BE ADDRESSED:

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species’ chances to survive and reproduce.
HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
HS-ESS2-7. Construct an argument based on evidence about the simultaneous coevolution of Earth’s systems and life on Earth.
HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*
HS-ESS3–5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as either motions of particles or energy stored in fields.
HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

HS-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics)

HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

**DISTRICT ESLRs to be ADDRESSED:**

**Students will be:**

- **Self-Directed Learners:** Students will choose a topic to research, investigate and write about during their Internal Assessment.
- **Effective Communicators:** Students will communicate through discussion and written work.
- **Quality Producers/Performers:** Students will produce college-level scientific work.
- **Constructive Thinkers:** Students will analyze the common hurdles and challenges of the past and connect them with the challenges of the present.
- **Collaborative Workers:** Students will work together to understand the context and significance of various aspects of science.
- **Responsible Citizens:** The course will support their work in CAS which requires students to serve within their community.