

## MAE 124 / ESYS 103 Midterm Study Guide

### *Objectives of the course:*

1. Introduce interaction of human activity with the “environment” in broad sense.
2. Demonstrate importance of embedding environmental dimension into industry, planning, design, economics, and politics.
3. Explore methodologies and look at case studies for accounting for environmental impacts and costs of human activity, while enabling the objective of “sustainable development” (i.e. development that meets the need of the present without compromising the ability of future generations to meet their own needs.)
4. Evaluate the severity and urgency of environmental problems and potential solutions from a variety of perspectives using knowledge and critical thinking skills developed in class.
5. Use methodologies and perspectives developed in class to quantify trade-offs for both the status quo (i.e. “business as usual”) and proposed alternatives.
6. Make informed decisions in your design for the future that account for and document the trade-offs in an objective manner.

### ***Weekly Topics and Goals***

#### *Week 1: Tragedy of the Commons*

1. Societal Collapse examples, causes
2. Tragedy of the Commons (inevitable for communal resources? Bad behavior drives out good?)
3. Tragedy of the commons applied to air quality (3 types of air pollution CFC, GHG, traditional),
4. Greenhouse warming, warming of the oceans, and sea level rise
5. Predict the consequences for various sea level rise scenarios for the California and the world (i.e. beyond a simple increase in ocean volume).
6. Ecological footprints as a measure of individual resource use.

#### *Week 2: Global Warming*

1. UCSD’s efforts to develop sustainable practices.
2. Explain the greenhouse process, how humans are enhancing the greenhouse effect, and the important feedback processes
3. Based on projections of global average temperatures in the near future (i.e. your lifetime), explain the likelihood and severity of a broad range of impacts for natural systems, humans, and the environment.
4. Apply your understanding of the scientific method, scientific reasoning, and the IPCC process to gauge the credibility of current and projected consequences of global warming. Understand current status of climate negotiations following Copenhagen talks in 2009.
5. The carbon cycle and greenhouse warming.
6. Comprehensive understanding of environmental challenges facing our society from multiple, objective view points

#### *Week 3: Peak Oil and Energy Resources*

1. Understand links between energy usage and economy.
2. Evaluate oil, coal, and natural gas availability in coming decades and centuries.
3. Evaluate proposed plans – including “business as usual” – for meeting future energy needs of the US. Describe the challenges, proposed solutions, and the potential consequences of various solutions.
4. Nuclear power, and the characteristics of fourth generation nuclear power generation.

5. Describe the pros/cons of major non-renewable energy sources (and risks, both perceived and real).

*Week 4: Water Issues for San Diego and the World*

1. Apply knowledge of the natural hydrologic cycle, California's water history and population, and California's water delivery infrastructure to assess vulnerabilities in present and future water supplies
2. Speculate and characterize future challenges water access and availability issues (San Diego and the world) based on past water resource issues and future water projections.
3. Nuclear energy as a potential fresh water source
4. Ecosystems, fishing down the food chain, and preserving the environment.

*Week 5: Population, Food, Agriculture*

1. Population growth, Malthus' projections, current UN population projections.
2. Population as a taboo topic---why population policies are difficult to negotiate
3. History of the Green Revolution: why Malthus' predictions haven't yet come true
4. Beyond the Green Revolution: GM crops and future agricultural goals
5. Deforestation, top soil loss and changing land use
6. Assess impact of expanding agriculture on ecosystems, and impact of converting agricultural lands to urban development.

*Week 6: Strategies for Sustainability*

1. Sustainable development: framework for ensuring survival
2. Synthesize understanding of the science and potential solutions to climate change to evaluate the merit and practicality of a proposed solution (i.e. "Wedges" described in Pacala and Socolow paper in Science magazine). Compare the merit and practicality from a global perspective to local interests. Evaluate potential impacts of proposed solutions on a local stakeholder and speculate on the preferences of the local stakeholder.
3. Triple bottom line, 3 E's (or 3P's)
4. Life cycle assessment (LCA) = Evaluation of a product system through all stages of its life cycle, usually with respect to its environmental impact
5. LCA -conceptual: qualitative discussion by identifying sates of life cycle and potential environmental impact of greatest significance; qualitative or obvious data
6. LCA-simplified: look at most important environmental impact but perhaps with generic or not precisely measured data. Three stages: screening, simplifying, assessment
7. LCA-detailed: see handout.
8. The electrical grid and challenges to using solar energy.

*Week 7: Alternative Energy*

1. Critically evaluate the advantages and disadvantages of alternative energy strategies to reduce accumulation of greenhouse gases in the atmosphere and to make a reasoned judgment about the effectiveness, scalability, and desirability these strategies.
2. Conservation
3. Nuclear, solar, wind, hydroelectric, biomass as energy sources
4. Carbon sequestration and geoengineering

*Week 8: Land Use, Building, Urban Planning*

1. Characterize green building strategies and the obstacles and benefits to their implementation
2. Evaluate benefits of LEED certifications (for the environment, builders, owners, and occupants)

3. Explain concepts of Smart Growth, new urbanism
4. Explain specific green building strategies, including natural ventilation, highly reflective roofs, energy-efficient windows

*Week 9: Transportation and Transportation Systems*

5. Evaluating true costs of personal vehicle transportation
6. Transit systems for urban areas; redesigning communities.
7. Articulate and explain past and current fleet fuel efficiency standards
8. Discuss improvements in efficiency and alternatives to ICE cars
9. San Diego plans for a future urban transit.

*Week 10: Meeting the needs of the developing world; What you can do*

1. Millenium Development Goals
2. Appropriate technology
3. Microcredit
4. Strategies for agriculture: organic farming, no-till agriculture, impact of meat consumption
5. Population: scope of problem, consequences, possible actions.
6. What you can do on a personal level, a community level, and a national level to address environmental challenges.
7. Using strategies learned in this class to make a difference.