ENERGY TECHNOLOGY AND POLICY
AME/EG 40401

SPRING SEMESTER 2015

DeBartolo Hall Room 208
M,W 4:05 – 5:20 pm

COURSE DESCRIPTION

INSTRUCTOR: Frank Incropera (fpi@nd.edu)
Office Hours: Tu, Th: 10 am to 12 pm.

PEER MENTOR: Chris Jasinski (cjasinsk@nd.edu)

CREDIT HOURS: Three

DESCRIPTION: The course provides a comprehensive treatment of the science and technology of energy production and conversion options, as well as related economic, political, environmental and social factors. After reviewing the benefits and problems associated with today's dependence on fossil fuels, attention is directed to the opportunities and challenges of transitioning to a sustainable energy future.

LEARNING OBJECTIVES: Goals include cultivating:

- the ability to quantify the different forms of energy and processes governing conversion from one form to another;
- a working knowledge of basic principles and performance parameters underlying traditional and emerging technologies based on fossil-fuels, nuclear energy, and renewable energies such as solar, wind, and biofuels;
- an understanding of the environmental consequences (*pollution* and *climate change*) of energy technologies;
- an awareness of the following non-technical issues on the nation's and the world's energy future:
  - *economics*,
  - *public policy*,
  - *geopolitics*, and
  - *ethics*.

Among the problems to be faced by this generation of college students *throughout their lives*, shaping a sustainable energy future ranks close to or at the top. This course is offered in recognition of the need to develop and implement thoughtful and comprehensive visions of

humanity's energy future. Its main objective is to provide students with the ability to synthesize diverse technical and non-technical issues in making informed decisions concerning this future.

LEARNING ACTIVITIES: Class time involves a mix of:

- lectures on technical and nontechnical matters,
- student presentations and group discussions of reading materials, and
- invited speakers from the corporate sector.

STUDENT EVALUATION: Grades will be based on:

- homework problems and essays (25%),
- mid-term examination (35%),
- team-based semester project (30%), and
- quizzes and class participation (10%).

READINGS:

- Instructor Notes
- Selected Articles

Academic Code of Honor: *As a member of the Notre Dame community, I will not participate in academic dishonesty.*

- Although collaborative study has educational value and is encouraged, all submitted homework must be that of the student.
  - A student may not copy from another student's homework problem solutions.
  - A student's essay must not plagiarize from the work of others, including online resources.
- A student may not give or receive unauthorized aid on a quiz or exam.
- If you become aware of an Honor Code violation, you must notify either the instructor or the Honesty Committee of the department within which the course is taught.

The Code of Honor will be strictly applied as described in *The Academic Code of Honor* (http://nd.edu/~hnrcode/docs/handbook.htm).

SEMESTER PROJECT:

Strategic Plan for Development of Light Duty Vehicles

The firm for which you work has been contracted by a global manufacturer of light duty vehicles to provide a strategic plan for ensuring competitiveness of its products through the year 2035. You and five of your colleagues have been assigned to a team responsible for developing the plan, which will be used by the company to guide its investments in product development and manufacturing operations, as well as global marketing and sales. Your final report must include:

- the current status of the global market, including annual LDV sales and portions of the market held by the following technology types: conventional gasoline, conventional diesel, hybrid, plug-in hybrid (PHEV), battery-electric (BEV), compressed natural gas (CNG), and fuel cell (FC);
- projected growth in annual vehicle sales through 2035, and changes in the market share held be each technology type, accounting for conditions that may vary from one nation or region to another; and
- specific recommendations for product development, differentiated if necessary according to different national or regional needs.

Issues to be considered include, but are not restricted to:

- the status of existing vehicle technologies and the potential for technology advancements over the 20 year period; considerations should include:
  - gasoline and diesel engine power trains;
  - battery technologies for PHEVs and EVs, related charging requirements, and linkages to the electric grid including evolution of a smart grids supplied by renewable and intermittent sources of electricity;
  - automotive CNG and FC technologies and related refueling requirements;
- the effect of trends and regional variations in the production and price of oil, natural gas, biofuels and electricity;
- life-cycle costs of ownership;
- the effect of policy measures such as CAFE standards, a cap and/or tax on carbon emissions and restrictions on other vehicle emissions;
- population and economic growth, particularly in emerging markets of Asia, Latin America and Africa;
- the effect of urbanization and competition from alternative modes of transportation; and
- the effect of changing demographics and lifestyle preferences.