1. Course number and name
   EML 4452 Sustainable Power Generation
2. Credits and contact hours
   3 cr, 2.5 contact hours (2 hrs. 30 min. lecture)
3. Instructor's or course coordinator's name
   Instructor: Dr. Juan Ordonez, Coordinator: Dr. Juan Ordonez
4. Text book, title, author, and year
   Fundamentals of Renewable Energy Processes, Da Rosa, A. V., 2012
5. Specific course information
   a. *brief description of the content of the course (catalog description)*
      This course is a continuation of energy-conversion systems for sustainability and focuses on solar electricity, biopower, biofuels, and hydrogen as energy media. The course also explores whether hydrogen-based transportation is a practical option.
   b. *prerequisites or corequisites*
      Prerequisite: EML 4450
   c. *indicate whether a required, elective, or selected elective course in the program*
      Selected Technical Elective course
6. Specific goals for the course
   a. *Course Outcomes*
      1. Be able to estimate solar radiation on horizontal and tilted surfaces [1, 4]
      2. Be able to analyze the performance of concentrating solar collectors [1, 4]
      3. Be able to explain the physics of solar cells [1]
      4. Be able to design and analyze a photovoltaic system for electricity generation [1, 2]
      5. Be able to perform the analysis of an hydrogen production and storage system
      6. Be able to articulate hydrogen safety and handling issues [3]
      7. Be able to design and analyze a PEM based fuel cell stack [3]
      8. Be able to carry out design calculations for a fuel cell power system [3]
      9. Be able to design solar-hydrogen based system for electricity generation
      10. Develop a suitable design for electricity generation system using solar radiation and Biomass
      11. Be able to present and discuss the scientific issues related to hydrogen economy
      12. Be an advocate of hydrogen generation using solar resources

      Numbers refer to Course Objectives below, e.g. for course outcome 1, [1, 4] refers to course objectives 1, 4.
   b. *Course Objectives and Relation to Student Outcomes*
      1. To provide an understanding of the concept of solar electricity [1]
      2. To provide a comprehensive engineering basis for photovoltaic system design [1, 3]
      3. To introduce the major methods of large-scale production of hydrogen from water [1]
      4. To provide a survey of energy storage methods [1, 5, 8]
      5. To introduce to modes of transduction and usage of hydrogen and biofuels

      Numbers refer to Departmental Student Outcomes, e.g. for course objective 1, [1] refers to student outcome 1.
7. Brief list of topics to be covered

- Introduction and review of fundamental thermal sciences, including thermodynamics, fluid mechanics and heat transfer, and how they can be applied to the design/analysis of IC, jet and rocket engines
- Introduction to solar thermal systems
- Estimation of solar radiation
- Solar cells
- Photovoltaic systems engineering
- Concentrating solar collectors
- The large scale production of hydrogen from water
- Energy storage
- Hydrogen safety aspects
- Usage of hydrogen – fuel cells
- Power generation from Biomass
- Biofuels
- Hydrogen based transportation
- Socio-economic assessment