SAMPLE SYLLABUS

This syllabus is to be used as a guideline only. The information provided is a summary of topics to be covered in the class. Information contained in this document such as assignments, grading scales, due dates, office hours, required books and materials may be from a previous semester and are subject to change. Please refer to your instructor for the most recent version of the syllabus.

ABET Course Syllabus EEE460

1. **Course: EEE 460 Nuclear Power Engineering**
2. **Credits and Contact Hours:** 3 Credit Hours (lecture), Topics: Engineering
3. **Course Coordinator:** Dr. K.E. Holbert, Associate Professor
4. **Textbook:** R. L. Murray and K. E. Holbert, *Nuclear Energy: An Introduction to the Concepts, Systems, and Applications of Nuclear Processes*, 8th ed., Elsevier Butterworth-Heinemann.
   Supplemental materials: http://holbert.faculty.asu.edu/eee460/eee460.html.
5. **Specific course information**
   a. **Catalog description:** Radioactivity and decay. Radiation interactions and dose. Nuclear reaction, fission and fusion theory. Fission reactors, four factor formula, moderation. Nuclear power, TMI, Chernobyl. Nuclear fuel cycle.
   b. **Prerequisites or co-requisites:** CHM 114 (or 116); MAT 274 (or 275); PHY 241 (or 361).
   c. **Required/elective/selected elective:** Elective
6. **Specific goals for the course**
   Provide students with an understanding of the multidisciplinary applications of nuclear concepts in the engineering profession
   a. **Outcomes of instruction:**
      1. Students will have usable knowledge of the physics behind nuclear concepts
      2. Students will understand the effects and uses of radiation
      3. Students will understand the principles of power generation via nuclear processes
   b. **Outcomes of Criterion 3 addressed by the course:**
      (1) Students must apply both mathematics and physics (and chemistry) to understand and solve problems in this course. Students utilize modern tools such as the computer to solve problems.
      (2) Students perform design-type analyses and solve engineering problems. To a lesser extent students learn how to implement electrical technology in applications such as spacecraft electronics.
      (4) This course addresses many aspects of contemporary issues, especially since Sept. 11, 2001 and concerns of terrorism.

7. **Brief list of topics to be covered**
   1. Thermal and radiant energy, relativistic energy and mass (1 lecture)
   2. Atomic and nuclear structure, binding energy/mass defect (2 lectures)
   3. Nuclear stability, radioactive decay modes and decay law (2 lectures)
   4. Transmutation, compound and serial decay chains (1 lecture)
   5. Nuclear reactions and energetics (2 lectures)
   6. Neutron cross sections, attenuation and migration (2 lectures)
   7. Radiation interactions (gamma, neutron, charged particles) (2 lectures)
   8. Nuclear fission and fusion (energy production) (1 lecture)
   9. Nuclear energy history (1 lecture)
   10. Biological effects of radiation (dose, cancer) (1 lecture)
   11. Radiation protection (dose calculation) (1 lecture)
   12. Neutron chain reactions, criticality, four factor formula (2 lectures)

13. Power reactors and power plants, economics (2 lectures)
14. Reactor kinetics, reactivity feedback and control, fuel burnup (2 lectures)
15. Reactor safety, Three Mile Island, Chernobyl, Fukushima (2 lectures)
16. Nuclear fuel cycle, radioactive waste disposal (2 lectures)
17. Nuclear propulsion, radioisotopic power (1 lecture)

Computer Usage:
Computer use is integrated within the homework assignments. Students are allowed to use the computer tools of their choice including Excel, Matlab, Mathcad, etc. Typically, the types of homework assignments requiring computer use include solving transcendental equations, and performing numerical integration. In addition, students must use the computer tools to plot results from the analysis of reference data and from the solution of numerical problems.

Laboratory Experiments: None.

Course Contribution to Engineering Science and Design:
This course teaches engineering science through the application of physics principles to engineering problems. For example, students use their physics knowledge to determine the effect of radiation on electronic components in the space environment. This course also affords the student the opportunity to solve open-ended problems involving the selection of a suitable engineering option based upon constraints. For example, students compare and contrast radioisotopic power sources for spacecraft use based upon mass, half-life, and specific power.

Person preparing this description and date of preparation: K. Holbert, K. Tsakalis, June, 2021.