

**Standardized Syllabus for ENU6937, ENU 4930:  
Perspectives On Nuclear Energy and Proliferation**

1. Catalog Description (3 Credits) –Historic and modern perspectives on nuclear (non) proliferation are studied with particular attention given to the interrelationships among nuclear explosives, fission concepts, and fusion concepts. The relevant underlying physics of each will be addressed.  
ENU 6937/Section 11G3; ENU 4930/Section 11G0
2. Pre-requisites and Co-requisites –Nuclear engineering physics and upper level mathematics background at the graduate or advanced undergraduate level or by instructor permission.
3. Course Objectives: **Following successful completion of this course, the student will have developed an integrated understanding of the genesis and technical bases from which global (non) proliferation challenges are evolving. Nuclear explosive technology and fission/fusion energy development will be interrelated to nuclear safeguards, 4<sup>th</sup> generation nuclear systems, (non) proliferation, and national security.**
4. Contribution of course to meeting the professional component:  
This course provides 3 credits towards Engineering Sciences and nuclear energy development, and national security.
5. Relationship of course to program outcomes:  
[This course integrates basic knowledge of mathematics, nuclear engineering science, and policy to identify present and future nuclear (non) proliferation challenges as they relate to the development of global nuclear energy and national security.]
  - a. ABET Program Educational Objectives/Professional Components
    1. Graduates will have successful careers in Nuclear Engineering and related disciplines.
    2. Graduates will pursue advanced degrees or continuing education.
  - b. ABET Program Outcomes Supported
    - i. Outcome a: Ability to apply knowledge of mathematics, science, and engineering to nuclear energy concepts.
    - ii. Outcome d: Ability to function on multi-disciplinary teams; term project.
    - iii. Outcome f: Understanding of professional and ethical responsibility; nonproliferation will continue to be a global responsibility.
    - iv. Outcome g: Ability to communicate effectively in both oral and written form; term project presentation and oral final.
    - v. Outcome h: Understanding of the global, societal, and environmental impact of engineering solutions; fuel cycles, spent fuel solutions, and materials safeguards.
    - vi. Outcome j: Knowledge of contemporary issues; definitely a major contemporary and evolving issue.

See the following website for the current list of MSE outcomes:  
<http://nuceng.ufl.edu/students/objectives-a-outcomes>

6. Instructor: Joseph M. Mack, Ph.D.
  - a. NSC 235
  - b. 352-846-1376
  - c. [jmack@mse.ufl.edu](mailto:jmack@mse.ufl.edu)
  - d. Office hours: M, W PM
  - e. Walk-in or appointments by email or phone
  - f. Meeting Times: Three times, every week
  - g. MWF 5<sup>th</sup> Period (11:45 AM – 12:35 PM)
  - h. Meeting Location: NSC 225
7. Material and Supply Fees: None
8. Textbooks and Software Required: None  
Selected course notes will be provided, as warranted.
9. Recommended Reading:

### **Nuclear Explosives Technology**

**The Los Alamos Primer**, Robert Serber: ISBN 0-520-07576-5

**The Effects of Nuclear Weapons**, Glasstone, S., Knowledge Publications  
(November 1, 2006), ISBN-13: 978-1603220163.

### **Fission Physics**

**The Physical Theory of Neutron Chain Reactors**,

[Alvin M. Weinberg and Eugene P. Wigner](#), ISBN-13: 978-0226885179, University of  
Chicago Press; 1<sup>st</sup> Edition (1958)

### **Fusion Physics**

**The physics of Fully Ionized Gases**, Lyman Spitzer, Jr.: ISBN 0-470-81723-2.

Francis F. Chen, **Introduction to Plasma Physics and Controlled Fusion**, 2<sup>nd</sup>  
Edition, ISBN: 0-306-41332-9, 1984, Plenum (Springer) Press, New York, NY.

**Inertial Confinement Fusion: The Quest for Ignition and Energy Gain Using  
Indirect Drive**, John Lindl: ISBN 156396662X.

### **Nuclear (Non) proliferation**

**Nuclear Safeguards, Security, and Nonproliferation**, James E. Doyle: ISBN 978-  
07506-8673-0.

**Hitler's Uranium Club: The Secret Recordings At Farm Hall**, J. Bernstein, D.  
Cassidy, 2<sup>nd</sup> Edition, Copernicus Books, (2001), ISBN 0-387-95089-3.

**Nuclear Proliferation: Opposing Viewpoints**, David L. Bender, Bruno Leone,  
Opposing Viewpoints Series, Greenhaven Press, Inc., 1992, ISBN 1-56510-005-0.

10. Course Outline:

**Overview:**

1. Course Introduction
2. Basic definitions and concepts

**Fission, Fusion, and Nuclear Explosives:**

3. Conceptual chronology
  - Historical genesis
  - Agnew lecture
4. Fission explosives
5. Thermonuclear explosives

**Fission Energy:**

6. Fission for power; fission for “other”
7. Selected advanced concepts
8. Nonproliferation issues

**Fusion Energy:**

9. Why fusion?
10. Fusion for power; fusion for “other”
11. Paths to controlled ignition
12. Selected advanced concepts
13. Nonproliferation considerations
14. Diagnostics of thermonuclear burn

**Modern Nuclear (Non) proliferation Challenges:**

15. Policy
  - Attempts at international governance
  - Important treaties
16. Safeguards
17. Fourth-generation nuclear weapons
20. Guest speaker (TBD)

Note: Adjustments in lecture topical coverage may be necessary to accommodate presentations, quizzes, exams, and guest speaker.

11. Attendance and Expectations:

**Regular attendance and active participation is paramount.** Although not quantitatively marked off, unexcused lack-of-attendance will be noticed and considered part of a semester participation factor. If a student anticipates missing a class, they should (if possible) let the instructor know beforehand (email OK). In any event it is the student's responsibility to see the instructor afterward to get any handout material and the lecture content and/or discussion for that class period; classmates can be of assistance, as well.

Operation of all cell phones, Ipods, kindles, etc. is verboten with two exceptions: a note-taking device in which case the instructor must be able to see it too and a condition whereby a student anticipates a situation that might require communications during class. Check with the instructor before class for permission.

Students are asked to leave several chairs near the back of the classroom empty as class starts so that late arrivals can use them. Students are allowed to arrive late provided they do not disturb others and it does not occur frequently. Frequent tardiness will be addressed by instructor-student conference.

**ALL email communication between student and instructor must be facilitated through the University of Florida system: [jmack@mse.ufl.edu](mailto:jmack@mse.ufl.edu)**

12. Grading – methods of evaluation: 100 points total for course

10 Friday quiz question (Take home) 20 points

Term Project: Written term project (individual or team, depending on class size) with presentation to class, topics to be selected from pre-arranged list or with instructor consent: 60 total points (written/oral partition of points, TBD)

End-of-semester Event (Format TBD): 20 points

13. Grading Scale\*:

- a. A 95-100
- b. A- 90-95-
- c. B+ 85-90-
- d. B 80-85-
- e. C+ 75-79+
- f. C 70-75-
- g. D+ 65-69+
- h. D 60-65-
- i. F <60

\* Note: There could be some small changes to this delineation of grades based on changing Departmental Policy.

Grades may be adjusted at the end of the course at the discretion of the instructor. Improvement over the course of the semester and classroom effort may be used to clarify close grade boundaries.

14. Grading policies: For more information on grades and grading policies, please visit: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>
15. Make-up Exam Policy: make-up exams are only given for exceptional circumstances and in accordance with University policy, and the request must be pre-approved by the lecturer.
16. Honesty Policy – All students admitted to the University of Florida have signed a statement of academic honesty committing honesty in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to yourself, to be honest in all work submitted and exams taken in this course and all others.
17. Accommodation for Students with Disabilities – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.
18. UF Counseling Services –Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
  - UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
  - Career Resource Center, Reitz Union, 392-1601, career and job search services.
19. Software Use – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

