

Syllabus for ENU6937, ENU 4930:
Perspectives On Nuclear Energy and Nonproliferation: Fall 2015

1. **Catalog Description** (3 Credits) –Historic and modern perspectives on nuclear 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 reviewed.
ENU 6937/Section 11G3; ENU 4930/Section 11G0
2. **Pre-requisites and Co-requisites** –Nuclear engineering or physics 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 nonproliferation challenges are evolving. Nuclear explosive technology and fission/fusion energy development will be interrelated to nuclear safeguards, security, and nonproliferation.
4. **Contribution of course to meeting the professional component:**
This course provides 3 credits towards Engineering Sciences and nuclear energy development.
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 nonproliferation challenges as they relate to the development of global nuclear energy.]
 - 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. 352-392-1401, X TBD
 - c. jmack@mse.ufl.edu
 - d. No home web site
 - e. Office hours: TBD
 - f. Walk-in or appointments by email or phone
7. **Teaching Assistant: N/A**
- c. Office location
 - d. Telephone
 - e. E-mail address
 - f. Office hours
8. **Meeting Times: Two times, every week (3 credits).**
9. **Class Schedule:**
- W: 11:45AM – 12:35 AM
 - F 10:40 AM– 12:35 PM
10. **Meeting Location: NSC 227**
11. **Material and Supply Fees:** None
12. **Textbooks and Software Required:** None
Selected course notes will be provided, as warranted.
13. **Recommended Reading (see 12 above):**

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.

Fusion Physics

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

Introduction to Plasma Physics and Controlled Fusion, 2nd Edition, Francis F. Chen,
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 Nonproliferation

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, 2nd 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.

Joint Comprehensive Plan of Action, Iran Nuclear Agreement, , P(5)+1,
Vienna, 14 July 2015.

14. Course Outline:

Overview:

1. Course Introduction
2. Basic definitions and concepts
3. Conceptual chronology (historical genesis)

Fission Energy:

4. Basic Physics of Fission Energy
5. Important Paths To Controlled Fission
6. Selected advanced concepts
7. Nonproliferation issues

Fusion Energy:

8. Basic Physics of Fusion Energy
9. Important Paths To Controlled Fusion
10. Selected advanced concepts;
11. Nonproliferation considerations
12. Diagnostics of thermonuclear burn: Case Study

Nuclear Explosives:

13. Fission Explosives
14. Thermonuclear Explosives

Nuclear Non-proliferation Challenges:

15. Policy
 - a. Effective International Governance
 - i. Existence (?)
 - ii. Deterrence (?)
 - b. International Agreements
 - i. NPT
 - ii. CTBT
 - iii. GNEP
 - iv. PLOWSHARE
16. Safeguards: Overview
17. Future-generation weapons
18. Guest speaker (TBD)

15. Attendance and Expectations:

Attendance is expected but will not be specifically marked off. **Regular and active participation is paramount.** If a student anticipates missing a class, they should have someone pick up handouts or take notes, and let the instructor know beforehand. Otherwise, a student should see the instructor afterward to get any handout material and the lecture content for that class period. Classmate pick up of handouts is also acceptable.

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

16. Grading – methods of evaluation:

10 Friday Quiz Questions (Take Home): 20 Points

Term Project: Written term project (individual or team, depending on class size and mix) with presentation to class; topics to be selected from pre-arranged list or with instructor consent: 50 Points

End-of-semester Event: 30 Points

17. Grading Scale

A+....95-100

A.....90-95-

B+.....85-90-

B.....80-85-

C+.....75-80-

C.....70-75-

D+.....65-70-

D.....60-65-

F.....<60

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.

18. Grading policies: For more information on grades and grading policies, please visit: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

19. 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.

20. 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.

21. 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.

22. 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.

23. 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.

24. Students are expected to provide feedback on the quality of instruction in this course based on 10 criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.

