

Syllabus for NUC-5020

CRITICALITY SAFETY

COURSE DESCRIPTION

This course assesses nuclear industry prevention of an accidental, unplanned, and inadvertent self-sustaining nuclear chain reaction that could result in large radiation exposures or release of radioactive materials to the environment. The course emphasis is on the analysis of processes or systems that involve fissile materials, double-contingency principles, independent events in processes that must occur concurrently, and the need for continuous improvements based on operating experience.

COURSE OBJECTIVES

After completing this course, you should be able to:

- CO 1** Explain nuclear criticality safety using basic nuclear criticality safety principles.
- CO 2** Compare and contrast the causes of the criticality accidents that have been reported in process facilities in terms of K-effective.
- CO 3** Discuss the content of ANSI/ANS-8.1/N16.1 that addresses nuclear criticality safety.
- CO 4** Evaluate the roles of benchmark experiments and of the transport theory and Monte Carlo methods in assessing criticality.
- CO 5** Assess the relationship of 'subcritical limit' to process limits for fuel facility operations.
- CO 6** Assess criticality safety of single units and arrays of fissionable materials.
- CO 7** Review the role of licenses issued by the USNRC and orders issued by the USDOE in the practice of criticality safety for US fuel cycle facilities.
- CO 8** Explain unique methods designed specifically for implementation of nuclear criticality safety in fuel cycle facilities.
- CO 9** Analyze the lessons learned from criticality accidents.

COURSE MATERIALS

You will need the following materials to complete your coursework. Some course materials may be free,

open source, or available from other providers. You can access free or open-source materials by clicking the links provided below or in the module details documents. To purchase course materials, please visit the [University's textbook supplier](#).

Required Textbook

- Knief, R. A. (1985). *Nuclear criticality safety: Theory and practice*. American Nuclear Society. ISBN-10: 0894480286

COURSE STRUCTURE

Criticality Safety is a three-credit online course, consisting of **six** modules. Modules include learning objectives, study materials, and activities. Module titles are listed below.

- **Module 1: Fundamentals**
- **Module 2: Criticality Accidents**
- **Module 3: Criticality Standards and Experiments**
- **Module 4: Subcritical Limits and Computational Methods**
- **Module 5: Regulation and Related Impacts**
- **Module 6: Practices and Fuel Facility Applications**

ASSESSMENT METHODS

For your formal work in the course, you are required to participate in online discussion forums, complete written activities, and complete a final project. See below for more details.

Consult the Course Calendar for assignment due dates.

Promoting Originality

One or more of your course activities may utilize a tool designed to promote original work and evaluate your submissions for plagiarism. More information about this tool is available in [this document](#).

Discussion Forums

This course requires you to participate in **six** graded discussion forums. There is also one ungraded but

required introduction forum in Module 1.

Online discussions provide an opportunity for you to interact with your classmates. During this aspect of the course, you respond to prompts that assist you in developing your ideas, you share those ideas with your classmates, and you comment on their posts. Discussion forum interactions promote development of a community of learners, critical thinking, and exploratory learning.

Please participate in online discussions as you would in constructive face-to-face discussions. You are expected to post well-reasoned and thoughtful reflections for each item, making reference, as appropriate, to your readings.

You are also expected to reply to your classmates' posts in a respectful, professional, and courteous manner. You may, of course, post questions asking for clarification or further elucidation on a topic.

Written Assignments

You are required to complete written assignments. Each written assignment focuses on the topics covered in related modules. The written assignments can be in various formats. You will be required to develop a PowerPoint presentation, solve some problems, or just answer questions in essay format.

Final Project

You are required to complete a final project on Criticality Safety Evaluation (CSE). You will be given a scenario of a company that expands the storage capacity of highly enriched uranium stockpiles. Your task is to move canisters into the three storage rooms to obtain maximum loading, while maintaining criticality safety within regulations. For complete guidelines and requirements of the final project, please refer to the **Final Project** area of the course website.

GRADING AND EVALUATION

Your grade in the course will be determined as follows:

- **Online discussions (6)**—30 percent
- **Written assignments (6)**—42 percent
- **Final project**—28 percent

All activities will receive a numerical grade of 0–100. You will receive a score of 0 for any work not submitted. Your final grade in the course will be a letter grade. Letter grade equivalents for numerical grades are as follows:

A = 93–100 B = 83–87

A–	=	90–92	C	=	73–82
B+	=	88–89	F	=	Below 73

To receive credit for the course, you must earn a letter grade of C or higher on the weighted average of all assigned course work (e.g., assignments, discussion postings, projects, etc.). Graduate students must maintain a B average overall to remain in good academic standing.

STRATEGIES FOR SUCCESS

First Steps to Success

To succeed in this course, take the following first steps:

- Read carefully the entire Syllabus, making sure that all aspects of the course are clear to you and that you have all the materials required for the course.
- Take the time to read the entire Online Student Handbook. The Handbook answers many questions about how to proceed through the course, how to schedule exams, and how to get the most from your educational experience at Thomas Edison State University.
- Familiarize yourself with the learning management systems environment—how to navigate it and what the various course areas contain. If you know what to expect as you navigate the course, you can better pace yourself and complete the work on time.
- If you are not familiar with Web-based learning be sure to review the processes for posting responses online and submitting activities before class begins.

Study Tips

Consider the following study tips for success:

- To stay on track throughout the course, begin each week by consulting the Course Calendar. The Calendar provides an overview of the course and indicates due dates for submitting activities, posting discussions, and scheduling and taking examinations.
- Check Announcements regularly for new course information.

COMMITMENT TO DIVERSITY, EQUITY, AND INCLUSION

Thomas Edison State University recognizes, values, and relies upon the diversity of our community. We strive to provide equitable, inclusive learning experiences that embrace our students' backgrounds, identities, experiences, abilities, and expertise.

ACCESSIBILITY AND ACCOMMODATIONS

Thomas Edison State University recognizes disability as a facet of diversity and seeks to advance access to its educational offerings. Students with disabilities may seek accommodations by contacting the Office of Student Accessibility Services via email at ada@tesu.edu or phone at (609) 984-1141, ext. 3415. Individuals who are deaf or hard of hearing may call the TTY line at (609) 341-3109.

ACADEMIC POLICIES

To ensure success in all your academic endeavors and coursework at Thomas Edison State University, familiarize yourself with all administrative and academic policies including those related to academic integrity, course late submissions, course extensions, and grading policies.

For more, see:

- [University-wide policies](#)
- [Undergraduate course policies and regulations](#)
- [Graduate academic policies](#)
- [Nursing student policies](#)
- [Academic code of conduct](#)