ENTC 4490 Special Topics: Human Performance for Nuclear Power Plant Engineers
Department of Engineering
Spring 2019

A. COURSE INFORMATION

Course number/section: ENTC 4490.W04
Class meeting time: TBA
Class location: Online through NPI

B. INSTRUCTOR INFORMATION

Instructor: Ruby Mehrubeoglu (TAMUCC course administrator)
Office location: EN 222D
Office hours: MWF 10:50-12:30 (for Dr. Mehrubeoglu), and by request
(for the online instructor)
Telephone: 361-825-3378
e-mail: ruby.mehrubeogluATtamucc.edu
Appointments: via phone or e-mail

C. COURSE DESCRIPTION

This course is divided into six modules: Human performance fundamentals, the organization and the processes, the individual worker, the engineer, corrective action programs and root cause analysis, and case studies including TMI-2, Chernobyl, Davis-Besse, and Fukushima Daiichi.

This course is offered to students pursuing non-nuclear majors as a part of the Nuclear Power Engineering Technology Certificate program. The course is divided into six modules: Human Performance Fundamentals, the Organization & the Processes, the Individual Worker, the Engineer, Corrective Action Programs and Root Cause Analysis, and numerous Case Studies including TMI-2, Chernobyl and Davis-Besse.

Human Performance Fundamentals. Using principles recognized by the HP industry, the fundamentals of human performance theory will allow students to understand the interrelationship between worker, culture, and organizations.

The Organization & the Processes. This topic details the various pieces and parts that provide the direction, expectations, design and much more to the individual for performing tasks. An individual’s performance cannot be any better than the support organization & processes equip it to be.

The Individual. This describes the various error drivers, tools, motivations & mindsets that combine to make or break an individual’s performance.
The Engineer. Here we discuss the role of the engineer, primarily at a nuclear power plant. It is important to understand how he/she is viewed by the Operations & Maintenance staffs. Their professionalism will play a key role in the overall performance of the plant. Tools and traps that are specific to most engineers will be detailed as well as how latent errors can eventually reveal themselves in event investigations.

Corrective Action Programs & Root Cause Analysis. The nuclear industry, as well as other industries, looks to CAP for ways to continuously improve. The student will learn basic root cause analysis techniques.

Final Case Study. Numerous case studies are dispersed throughout the entirety of this course. The student will analyze an event by asking the instructor questions suited for different personnel on that particular job.

Nuclear Power – a higher standard. We will discuss the nuclear power industry & the standards that are maintained. We will compare those to other industries.

D. PREREQUISITES AND COREQUISITES

Prerequisites
Prerequisites: ENTC 4490.W001 NPP Fundamentals; junior or senior classification; approval of the instructor.

Corequisites
N/A

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES

Required Textbook(s)

Lecture Notes/Other References

Other Resources (online)

1. Chemical Safety Board website, CSB.gov
a. Anatomy of a Disaster – the BP Texas City refinery explosion on 3/23/2005 (55 min)
   http://www.csb.gov/videoroom/detail.aspx?vid=16&F=0&CID=1&pg=1&F_All=Y
b. Blast Waves in Danvers – Massachusetts paint company explosion on 11/22/2006 (19
1. Fire from Ice – Texas Panhandle Valero plant fire on 2/16/2007 (13 min)
   http://www.csb.gov/vidoroom/detail.aspx?vid=18&F=0&CID=1&pg=1&F_All=y

c. Fire from Ice – Texas Panhandle Valero plant fire on 2/16/2007 (13 min)
   http://www.csb.gov/vidoroom/detail.aspx?vid=4&F=0&CID=1&pg=1&F_All=y

d. Explosion at Formosa Plastics in Illinois on 4/23/2004 (10 min)
   http://www.csb.gov/vidoroom/detail.aspx?vid=9&F=0&CID=1&pg=1&F_All=y

2. YouTube website case studies

b. BHOPAL UNION CARBIDE GAS RELEASE (4 parts)
   http://www.youtube.com/watch?v=v4QPPELiDjY

c. Meltdown at TMI, 1999. Cable TV documentary. (6 parts)
   http://www.youtube.com/watch?v=eLPAigMuBk0

d. Phil Day – Challenger (6 parts) http://www.youtube.com/watch?v=hrNPCMvCDps

e. Birgenair Flight 301 (5 parts) http://www.youtube.com/watch?v=CzsF-7i7ui4

f. Northwest Flight 255 crash (5 parts) http://www.youtube.com/watch?v=1QF7kg6n2FA

g. Flight Air Florida 90 (Plane Crash In The Potomac) (4 parts)
   http://www.youtube.com/watch?v=m2ww2rCbX94

h. Technicians racking in breaker results in explosion
   http://www.youtube.com/watch?v=BNdRhS6FWjE

3. Darker Shades of Blue: A Case Study of Failed Leadership By Major Tony Kern

4. How Nuclear Power Works @ http://science.howstuffworks.com/nuclear-power.htm

6. FAA.GOV – FEDERAL AVIATION ADMINISTRATION WEBSITE
7. NRC.GOV – NUCLEAR REGULATORY COMMISSION WEBSITE
8. NTSB.GOV – NATIONAL TRAFFIC SAFETY BOARD WEBSITE
9. IAEA.ORG – INTERNATIONAL ATOMIC ENERGY AGENCY WEBSITE
10. AHRQ.GOV – AGENCY FOR HEALTHCARE RESEARCH & QUALITY

- New course materials may be uploaded to the course WebCT page. Each new upload will be followed up with E-mail notifications sent to the class.
- Students are expected to check the WebCT course page regularly and be up-to-date with course material, progress and assignments.

Supplies
N/A

F. STUDENT LEARNING OUTCOMES AND ASSESSMENT

Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the course’s student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.

By the end of this course, students should be able to:
1. Understand the importance of human performance and its effect on the a well-functioning organization
2. Understand the nuclear safety culture and its implementation in nuclear facilities
3. Ability to function effectively and safely on multidisciplinary and multicultural teams
4. Ability to communicate effectively with peers, subordinates, and superiors
5. Understand professional and ethical responsibilities in nuclear organizations
Learning Objectives

1. Explain Human Performance fundamentals including:
   a. The 5 principles of Human Performance
   b. The difference/link between an error and an event c. The 6 variables that affect job performance
   d. The 3 performance modes
   e. The 20 common accident components
   f. The value of operating experience

2. Explain the role the organization & the processes play in Human Performance including:
   a. Procedure use & quality
   b. Minimizing “shots on goal”
   c. Culture
   d. Design
   e. Latent weaknesses
   f. Training
   g. Equipment reliability
   h. Management’s expectations
   i. Job site issues

3. Explain the individual worker’s role in Human Performance including:
   a. Tools that minimize errors when used consistently
   b. Error Drivers to be aware of
   c. Motivation
   d. Understanding the performer is the last defense
   e. Mindsets/behaviors

4. Explain the role the engineer plays in Human Performance including:
   a. Understanding the relationship between engineer and client
   b. Tools specific to the engineer
   c. Error Drivers specific to the engineer
   d. The importance of getting into the field
   e. Professionalism – what it looks like
   f. The role of the Shift Technical Advisor

5. Using learned methods of analysis, participate in a basic classroom investigation of an event to find the causes.

6. Explain the high standards associated with nuclear power plants.
G. INSTRUCTIONAL METHODS AND ACTIVITIES

The lectures will consist primarily of presentations. Students are responsible for the material covered in the course lectures and other assignments. Their knowledge will be evaluated as described below.

H. MAJOR COURSE REQUIREMENTS AND GRADING

Assessment is based on the following. The final grade is computed as indicated:

- Homework Assignments: 40%
- Mid-Term Exam: 30%
- Final Exam: 30%

**Homework Assignments:** Homework is an important part of this course. HW assignments will be assigned almost every class. HW assignments will include reading material and other exercises like viewing YouTube videos. Homework will be graded according to answers given by students when asked questions during class.

**Example:** You were told to view a video on Three Mile Island. The next class the instructor may begin the class by asking a student, “Peggy, did President Carter take his wife with him when he toured TMI just following the accident?” or “Joe, how would you characterize the role Harold Denton of the NRC played in the endeavors following the accident?” If the student did the homework the answers will not be difficult. Each homework assignment will be graded as Pass/Fail. At the end of the semester, those students who consistently did all homework will receive a 100% for 40% of the total grade. For those that did half of their assignments, they will receive a 50%. In the event that a student does not attend the class with the instructor & other students, the instructor will test the student’s homework completion another way, possibly via email.

**Examinations:** Two major exams will be given during the semester. A mid-term examination will be conducted according to the course schedule. A final exam for the class will be scheduled according to the approved University Final Examination Schedule. This exam will be comprehensive. Questions about exam scores must be submitted in writing within one week after the exams have been returned or the scores will be considered correct.
## I. COURSE CONTENT/SCHEDULE

<table>
<thead>
<tr>
<th>Week</th>
<th>Lesson</th>
<th>Topic</th>
<th>Topics will cover:</th>
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<tbody>
<tr>
<td>1</td>
<td>1</td>
<td><em>Introduction</em></td>
<td>Bound course, establish importance of Human Performance (HP), review syllabus</td>
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<td>1</td>
<td>2</td>
<td><em>The Nuclear Industry</em></td>
<td>What makes it different: standards, culture &amp; event consequences</td>
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<td>2</td>
<td>3</td>
<td><strong>Human Performance Fundamentals</strong></td>
<td>Errors vs. Events, Errors vs. Violations, Defense strategy, Operating Experience,</td>
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<td>Prevention/Detection/Correction, Performance modes, Variables affecting job</td>
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<td>performance, HP Industry, Company triangle, Common Accident</td>
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<td>2</td>
<td>4</td>
<td><em>Human Performance Fundamentals</em></td>
<td>Building defenses like procedures, equipment reliability, training &amp; simple</td>
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<td>processes. Understanding latent weaknesses and human factors engineering.</td>
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<td>Management’s expectations &amp; culpability in HP problems, culture, budget, design,</td>
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<td>quality &amp; job site issues. Minimize shots on goal. Case studies</td>
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<td><em>Human Performance Fundamentals</em></td>
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<td><em>Human Performance Fundamentals</em></td>
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<td>9</td>
<td><strong>The Organization &amp; the Processes</strong></td>
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<td><em>The Organization &amp; the Processes</em></td>
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<td><em>The Organization &amp; the Processes</em></td>
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<td><em>The Organization &amp; the Processes</em></td>
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<td>7</td>
<td>13</td>
<td><strong>The Individual/Worker/End User</strong></td>
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<td>Personalities, error drivers, tools as barriers to errors, motivation, last</td>
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<td>defense, mindsets/behaviors. Case studies.</td>
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<td><em>The Individual/Worker/End</em></td>
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<td><em>The Individual/Worker/End</em></td>
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<td><em>The Individual/Worker/End</em></td>
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<td>17</td>
<td><em>The Individual/Worker/End</em></td>
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<td>10</td>
<td>18</td>
<td><strong>Review for mid-term</strong></td>
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<td>10</td>
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<td><strong>MID-TERM EXAM</strong></td>
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<td>Personalities, understanding the client, remembering the end user, professionalism, field observations, tools &amp; traps specific to engineers, role of the STA, Can do versus can’t do mentality, owning a system. Case studies.</td>
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<td>11</td>
<td>19</td>
<td><em>The Engineer</em></td>
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<td><em>The Engineer</em></td>
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<td><strong>CAP &amp; Root Cause</strong></td>
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<td>13</td>
<td>24</td>
<td>NUREG/CR-6753</td>
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<td>14</td>
<td>25</td>
<td><em>Case Study – Breaker</em></td>
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<td>26</td>
<td><em>Nuclear Power – a Detailed overview</em></td>
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<td>15</td>
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<td><strong>Review for Final Exam</strong></td>
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<td>15</td>
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<td><strong>Reading day – no class</strong></td>
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<tr>
<td>Final</td>
<td>exam</td>
<td><strong>FINAL EXAM</strong></td>
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8
J. COURSE POLICIES

Academic Dishonesty:
As commonly defined, plagiarism consists of passing off as one’s own the ideas, work, writings, etc., that belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you have the permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated.

Professional behavior: an important attribute of your professional development is that you act and speak in a manner that does not offend others, giving particular care to diversity issues.

Religious holidays: Observance of a religious holiday, to be excused the student must notify his or her instructor in writing (acknowledged e-mail message is acceptable) prior to the date of absence if such notification is feasible. In cases where advance notification is not feasible (e.g. accident, or emergency) the student must provide notification by the end of the second working day after the absence. This notification should include an explanation of why notice could not be sent prior to the class. Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

CASA Writing Center: TAMUCC CASA Writing Center, Glascock Building, offers help to writers at any stage of the writing process with 30-minute appointments. Meeting with CASA Writing Center staff is highly recommended but are not required and will not directly affect your final grade.

Courtesy notice: Students are encouraged to behave in a professional, respectful and courteous manner. The use of cell phones is forbidden and your phones should be turned off during the class time. Please no food and/or snack during the class. You may have your snack before class begins or after the class.

Copyright Notice
The handouts used in this course are copyrighted. By “handouts,” this means all materials generated for this class, which includes but is not limited to syllabi, quizzes, exams, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless expressly granted permission (for more information, contact the instructor).

K. COLLEGE AND UNIVERSITY POLICIES

- Academic Integrity (University)
University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic
misconduct or complicity in an act of academic misconduct on an assignment or test will result in a failing grade.

- **Classroom/Professional Behavior**
  Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

- **Statement of Civility**
  Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin, religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

- **Deadline for Dropping a Course with a Grade of W (University)**
  I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. Please consult with your academic advisor, the Financial Aid Office, and me, before you decide to drop this course. Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Please consult the Academic Calendar (http://www.tamucc.edu/academics/calendar/) for the last day to drop a course.

- **Grade Appeals (College of Science and Engineering)**
  As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at http://www.tamucc.edu/provost/university_rules/index.html, and the College of Science
and Engineering Grade Appeals webpage at http://sci.tamucc.edu/students/GradeAppeal.html. For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

- **Disability Services**
  The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.

  If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

  http://disabilityservices.tamucc.edu/

- **Statement of Academic Continuity**
  In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University–Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

L. **OTHER INFORMATION**

- **Academic Advising**
  The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The College’s Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

**GENERAL DISCLAIMER**
I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner through online media.