



# THE FACULTY SENATE

September 20, 2010

## MEMORANDUM

**TO:** Dr. R. Bowen Loftin, President  
**FROM:** Bob Strawser, Speaker *BJS*  
**SUBJECT:** Approval of Graduate Council Item **(FS.28.33)**

At its regular meeting on September 13, 2010, the Faculty Senate approved the following curriculum item from the Graduate Council. The Faculty Senate submits it for your approval. Attached is a copy of the material sent to our Senators.

**Special Consideration** -August 5, 2010  
**College of Engineering**  
 Graduate level Safety Engineering Certificate

Thank you for your time and consideration. Please inform me of your action on this matter.

### Attachment

cc: Karan Watson  
 Martyn Gunn  
 Antonio Cepeda-Benito  
 Sandra Williams  
 Robert Webb  
 David Reed  
 Kemble Bennett

Approved:

R. Bowen Loftin, President

10/1/10

Date



UCC/GC AUG 05 2010  
FS SEP 13 2010  
Pres. App OCT 01 2010  
SIMS OCT 06 2010  
Catalog 2011-2012 *SC 134*



RECEIVED

SEP 07 2009

R. AUTENRIETH

Mary Kay O'Connor Process Safety Center

August 20, 2009

MEMORANDUM

TO: Dr. Robin Autenrieth *RA*

THROUGH: Dr. Michael V. Pishko, Department Head  
Artie McFerrin Department of Chemical Engineering

FROM: Dr. M. Sam Mannan, Director  
Mary Kay O'Connor Process Safety Center *[Signature]*

SUBJECT: Safety Engineering Certificate- Graduate Level Certificate

*AS for MVP*  
*[Signature]*

OFFICE OF GRADUATE STUDIES  
JUL 26 2010  
ENTERED

*Approved*  
*[Signature]*  
*Mark T. Zoraw*

As you are aware, the Safety Engineering program is administered by me through the Mary Kay O'Connor Process Safety Center with the support of Dr. Mike Pishko, Department Head of the Artie McFerrin Department of Chemical Engineering and is an interdisciplinary program in engineering. In the Safety Engineering program, currently there are 2 components: MS in Safety Engineering and Safety Engineering Certificate-undergraduate program. The undergraduate certificate program has awarded 21 certificates since the program was initiated and in the last two years we have had 21 enroll and are taking courses for completion.

Within the past year, we have received inquiries if the current undergraduate certificate was available for graduate students. With this type of interest, we developed a graduate level certificate, due to an increase and a demand for the program has been expressed. Dr. Pishko agrees to provide support and faculty assistance in teaching the necessary courses. The courses offered as elective courses have been offered within those departments in the past two years as part of their regular curriculum. This certificate program will not burden those departments with any additional costs.

The Safety Engineering Program is a vital part of the safety awareness and mission established by the Process Safety Center and we continue to educate and promote the significance in placing safety first. The certification is an indication of commitment by the Center as well as the students who complete the program. Therefore, I am requesting that this certification be made a part of a student's transcript record. The certification would recognize a student's educational accomplishments.

If I can provide any additional information on the Safety Engineering Certificate program or answer any questions regarding the academic enhancement this program promotes, please contact me.

**TEXAS A&M UNIVERSITY  
DWIGHT LOOK COLLEGE OF ENGINEERING**

**Proposed Graduate Level Certificate Program  
In Safety Engineering**

**Purpose**

Safety concern has risen to the forefront in industry as a response to recent incidents, competitive threats and opportunities, legislation and regulation changes, and national security. As such, safety engineers are in high demand. Due to the limited supply of students with a Safety Engineering background and the maturing of the workforce, the demand for graduates is high. Emerging business leaders must understand Safety Engineering to keep their companies competitive or even survive. The objective of the proposed program is to better satisfy the growing demand for safety professionals within the State of Texas and build national recognition for Safety Engineering at Texas A&M University. No other Safety Engineering program was identified within the State of Texas or Southwest. Hence, the program will make a unique contribution to the state.

This certificate will be advertised through departmental advisors, Engineering Academic Program Office, the Artie McFerrin Department of Chemical Engineering, and the Mary Kay O'Connor Process Safety Center websites.

**Audience**

The graduate level Safety Engineering Certificate Program is intended to meet the call from industry to produce engineering graduates with a knowledge and understanding of Safety Engineering as applied to standard engineering practices in all disciplines.

The Safety Engineering Certificate requirements are achievable and relevant to all engineering disciplines. Graduate students in any engineering discipline can choose this option as part of their curriculum. Through this option, students are exposed to principles and case histories from a wide variety of engineering disciplines. The curriculum emphasizes the interdisciplinary nature of safety, health, and environmental engineering. It also emphasizes the knowledge and skills most likely to be needed by any engineer, as well as those who specialize in Safety Engineering.

**Benefits**

Industry recognizes the criticality of well-trained safety, health and environmental managers. Few graduate programs exist that specifically prepare students for careers in Safety Engineering. This proposed program would be one of a small, select cadre of national programs designed to correct this current situation facing U.S. firms. The program will serve as a research resource

and a provider of graduates who will become Safety Engineering executives and leaders that will assist the State of Texas in meeting its economic and industrial needs.

Locally the program offers substantial benefits to the students, faculty, and graduates of Texas A&M University and makes a significant contribution to developing Safety Engineering leadership for the state and region. As the Texas economy strives to attract new value-added industries to this region and increase international trade and business development, the program can be very important to the State. Example benefits are:

- Establishing the Dwight Look College of Engineering and Texas A&M as one of the select national graduate programs, which the multidisciplinary program needed for Safety Engineering.
- Attracting high quality, mature students interested in Safety Engineering.
- Preparing graduates who will become industry leaders within 5-7 years after graduation.
- Providing an excellent opportunity to significantly increase and broaden the interaction between the business and engineering colleges through shared curriculum and by offering students advanced degree options.
- Providing an excellent opportunity to build and leverage synergies among the proposed Master of Science in Safety Engineering, Master of Science in Chemical Engineering, and Doctor of Philosophy in Materials Science and Engineering.
- Encouraging faculty and students from diverse functional areas to engage in joint education and research.
- Enhancing university/industry partnerships through the use of external advisory and development activities.
- Increasing the number of student projects involving industry-based internships.
- Providing a high quality graduate student population for feeding the PhD program and research in Safety Engineering.
- Enhancing external visibility will aid in establishing a nationally recognized programs in Safety Engineering at the undergraduate and graduate level at Texas A&M University.

The proposed graduate level Safety Engineering Certificate Program supports Texas A&M's Vision 20/20 strategy and the Dwight Look College of Engineering's strategic objectives relating to enhanced graduate education, research, and external development.

## **Description**

The Safety Engineering Certificate- Graduate Program requirements are achievable and relevant to all engineering disciplines. Graduate students in any engineering discipline can choose this option as part of their curriculum. Through this option, students are exposed to principles and case histories from a wide variety of engineering disciplines. The curriculum emphasizes the interdisciplinary nature of safety, health, and environmental engineering. It also emphasizes the knowledge and skills most likely to be needed by any engineer, as well as those who specialize in Safety Engineering.

The proposed Safety Engineering Certificate – Graduate Program, which will be administered by the Mary Kay O'Connor Process Safety Center, seeks to serve all engineering disciplines equally well. The certificate requires 12 hours of coursework. It is the intent that these hours are applicable to the hours necessary for graduation and not an additional load, but this will depend on the disciplines' specific course requirements. Receiving the certificate is not dependent on conferral of a degree. Of the total hours required for the Certificate, six hours are dedicated to Basic Topics and are required for everyone in the program. An additional six hours address more specific or advanced topics. The advanced topics are cross-listed with numerous departments.

## **Required Courses**

The Safety Engineering Certificate-Graduate Program, administered by the Mary Kay O'Connor Process Safety Center, is relevant to all engineering disciplines and teaches knowledge and skills required for safety, health, and environmental engineering. The certificate requires 12 hours of courses that are applicable to the graduation requirement:

Required Courses	1b (1)	1c (2)
<b>SENG/CHEN 655 – Process Safety Engineering</b>	3-0	3
<b>SENG/CHEN 660 – Quantitative Risk Analysis</b>	3-0	3
<b>And select 2 courses from the following:</b>		
<b>CHEN 661 – Optimization in Chemical Engineering</b>	3-0	3
<b>CVEN 610 – Environmental Risk Assessment</b>	3-0	3
<b>GVEN 655 – Structural Reliability</b>	3-0	3
<b>CVEN 686 - Offshore &amp; Coastal structures</b>	3-0	3
<b>ISEN 612 – Design by Reliability</b>	3-0	3
<b>ISEN 627 – Engineering Analysis for Decision Making</b>	3-0	3
<b>ISEN 630 – Human Operator in Complex Systems</b>	3-0	3
<b>MEEN 652 – Multiple Control System Design</b>	3-0	3
<b>NUEN 612 – Radio Safety &amp; Hazards</b>	3-0	3
<b>NUEN 689 - Fuel Cycle &amp; Safeguard</b>	1-4	3
<b>SENG 635 – Directed Studies</b>	3-0	3
<b>SENG 422 – Fire Protection Engineering</b>	3-0	3
<b>STAT 601 – Statistical Analysis</b>	3-2	4

## Faculty

The faculty members teaching the required courses for this certificate are housed in the Artie McFerrin Department of Chemical Engineering. Faculty members teaching the elective courses are housed in their respective departments.

## Program Resources

### A. Library Resources

**1. List any Library holdings added in the past three years in anticipation of the program.**

In the last year alone, the MKOPSC library has added 878 publications in the areas of: Codes & Standards; Chemistry & Physics; Cryogenics, Liquefied Natural Gas (LNG) and Liquefied Propane Gas (LPG); Conference and Symposium Proceedings; Case Histories and Studies; Explosion and Blast Modeling; Environmental; Ethics; Fluid Flow; Fires-Prevention & Protection; Hazard Assessment; Heat and Mass Transfer; Hazardous Materials; Industrial Hygiene Safety & Occupational Safety; Incident Investigation and Analysis; Instruction Manuals; Maintenance/Reliability/Mechanical Integrity; Math; Natural Disasters; Plant Design & Inherent Safety; Petroleum Engineering; Pipelines; Process Safety Management; Hazard, Risk Analysis & Reliability; educational videos.

In addition, there are already plans to add over 1,000 books in these various categories.

**2. Cooperative library arrangements available to students in this program.**

The MKOPSC Library within the Department of Chemical Engineering has over 12,000 publications related to Safety Engineering (Appendix B).

In terms of overall size, the Library holds well over 100,000 volumes in process safety-related fields and provides access to over 200 process safety-related journals.

- Journals include Journal of Loss Prevention in the Process Industries, Journal of Hazardous Materials, Process Safety and Environmental Protection, American Institute of Chemical Engineers (AIChE) Journal and Process Safety Progress.

The Library has over 1600 books and almost 5000 articles that focus on chemical engineering, process safety and many other chemical safety related topics. This library is unique because most of the resources have been donated and are very rare.

Visitors to the website (<http://psc.che.tamu.edu/library>) can search for material by category, title, keywords, or author. Many of the faculty members in the Artie McFerrin Department of Chemical Engineering give class assignments or research projects related to specific or unique topics with reference materials only available from the Center library. Because of this, many students have been exposed to the facility and sparked them to seek out more information on and an understanding of process safety.

## **B. Training Resources**

A unique feature of this program is the high level of interaction with industry and the opportunities for outside training. As part of the MKOPSC, several courses are offered as part of the continuing education program of the Center (Appendix C) <http://psc.tamu.edu>. Graduate students in the Masters of Process Safety Engineering would have the opportunity to attend these courses. These courses are taught by experts in their field who are in industry on topics relevant to the industry needs and current government regulations. The graduate students in this program will have the opportunity to not only be

**taught by these experts, but sit in classes with current process safety personnel discussing real-life situations occurring in the plants. This also affords them the opportunity to begin a network of contacts in the field for their own coursework.**



***Required Courses:***

***SENG/CHEN 655 - Process Safety Engineering. (3-0). Credit 3.***

Applications of engineering principles to process hazards analysis including source and dispersion modeling, emergency relief systems, fire and explosion prevention and mitigation, hazard identification, risk assessment, process safety management, etc. Prerequisites: Approval of instructor.

***SENG/CHEN 660 Quantitative Risk Analysis. (3-0). Credit 3.***

Fundamental concepts, techniques, and applications of risk analysis and risk-informed decision making for engineering students. Practical uses of probabilistic methods are demonstrated in exercises and case studies from diverse engineering areas. Prerequisites: Graduate or Senior status. Cross-listed with SENG 660 and ISEN 660.

***Select two courses from the following:***

***CHEN 661 - Optimization of Chemical Engineering Processes. (3-0). Credit 3.***

Methods of optimization applied for the design and control of chemical engineering processes. Prerequisite: Approval of instructor.

***CVEN 610 - Environmental Risk Assessment. (3-0). Credit 3.***

Risk assessment of the environment and human exposure in a statistically-based approach to determine allowable levels of exposure without significant deleterious effects; the basic approach of hazard identification; data collection and analysis; toxicity assessment; risk characterization; applications in ecological and human risk assessment; risk analysis performed. Prerequisite: CHEM 222 or equivalent. Cross-listed with PHEO 650.

***CVEN 655 - Structural Reliability. (3-0). Credit 3.***

Uncertainties in structural mechanics; probabilistic models for load and resistance variables, fundamentals of structural reliability theory, advanced first-order second moment methods and reliability of complex structural systems; applications to selected structures. Prerequisites: CVEN 345 and 421.

***CVEN 686 - Offshore and Coastal Structures. (3-0). Credit 3.***

Fundamental design and analysis techniques; offshore platforms for shallow and deep water, pile supported, gravity based and floating platforms; new design problems faced by offshore industry will be examined by class during the semester. Prerequisite: Approval of instructor.

***ISEN 612 - Design by Reliability. (3-0). Credit 3.***

Quantitative reliability analysis in engineering design. Reliability methods applicable to risk based design, component reliability and degradation, static and dynamic system reliability modeling and analysis, life testing, stress/strength analysis, and fault tree analysis. Prerequisites: ISEN 609.

***ISEN 627 - Engineering Analysis for Decision Making. (3-0). Credit 3.***

Principles and application of techniques in analysis of decision processes involving engineering systems under uncertainty. Areas of utility and information theory as related to quantification of information for decision-making. Prerequisites: ISEN 609 or approval of instructor.

***ISEN 630 - Human Operator in Complex Systems. (3-0). Credit 3.***

Basic understanding of the theory and practice of human factors engineering. Topics are presented within the framework of humans as functioning systems and their requirements when incorporated in hardware and software systems.

***MEEN 652 - Multivariable Control System Design. (3-0). Credit 3.***

Advanced issues relevant to the design of multivariable control systems using hybrid (time and frequency domain) design methodologies; design using the LQG/LTR method and advanced practical applications using various robust control system design techniques. Prerequisite: MEEN 651 or ECEN 605. Cross-listed with NUEN 619.

***NUEN 612 - Radiological Safety and Hazards Evaluation. (3-0). Credit 3.***

State and federal regulations concerning radioactive materials; radiation safety as applied to accelerators, nuclear reactors and radioactive byproducts; rigorous methods of analysis applied to computation of biological radiation dose and dose rates from various sources and geometries; radiation effects on physical systems. Prerequisites: NUEN 613; MATH 308.

***NUEN 689 - Special Topics in... Credit 1 to 4.***

Selected topics in an identified area of nuclear engineering. May be repeated for credit. Prerequisite: Approval of instructor.

***SENG 685 - Directed Studies. Credit 1 to 12 each semester.***

Investigation of topics not within the scope of thesis or dissertation research and not covered by other formal courses.

***SENG 422 – Fire Protection Engineering. (3-0). Credit 3.***

Fire protection design concepts and considerations for chemical, petrochemical and hydrocarbon processing facilities. Special attention given to fire hazard analysis, fire risk assessment, fire protection features, and emergency response. Specific fire protection design considerations are studied for the various types of facilities and processes. Prerequisite: Instructor approval

***STAT 601 - Statistical Analysis. (3-2). Credit 4.***

For students in engineering, physical and mathematical sciences. Introduction to probability, probability distributions and statistical inference; hypotheses testing; introduction to methods of analysis such as tests of independence, regression, analysis of variance with some consideration of planned experimentation. Prerequisite: MATH 152 or 172.

# TEXAS A&M ENGINEERING

## Safety Engineering Certificate

### Worksheet

**Student Name:** \_\_\_\_\_ **Date:** \_\_\_\_\_ **UIN:** \_\_\_\_\_  
**Email:** \_\_\_\_\_ **Catalog #:** \_\_\_\_\_

A student must complete a minimum of 12 semester credit hours selected from the list below:

<u>Required Course</u>	<u>Semester Taken</u>	<u>Grade Received</u>
SENG/CHEN 655 (3) – Process Safety Engineering	_____	_____
SENG/CHEN 660 (3) – Quantitative Risk Analysis	_____	_____

### Approved Additional Courses

CHEN 661 – Optimization in Chemical Engineering	_____	_____
CVEN 610 – Environmental Risk Assessment	_____	_____
CVEN 655 – Structural Reliability	_____	_____
CVEN 686 - Offshore & Coastal structures	_____	_____
ISEN 612 – Design by Reliability	_____	_____
ISEN 627 – Engineering Analysis for Decision Making	_____	_____
ISEN 630 – Human Operator in Complex Systems	_____	_____
MEEN 652 – Multiple Control System Design	_____	_____
NUEN 612 – Radio Safety & Hazards	_____	_____
NUEN 689 - Fuel Cycle & Safeguard	_____	_____
NUEN 689 – Criticality Safety	_____	_____
SENG 685 – Directed Studies	_____	_____
SENG 422 – Fire Protection Engineering	_____	_____
STAT 601 – Statistical Analysis	_____	_____

**Note:** This form will be verified by the Mary Kay O'Connor Process Safety Center and approval given upon verification of requirements by the Program Coordinator to earn the certificate.

**For the Mary Kay O'Connor Process Safety Center:**

Verified by: \_\_\_\_\_ Date: \_\_\_\_\_