

ENG 494 Safety Engineering and Management

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Office hours	:	
Course hours	:	
Classrooms	:	
Course website:	: http://moodle.ie.boun.edu.tr/	
Enrollment key	:	
Prerequisite	:	

Catalog Description: Safety engineering is devoted to the application of scientific and engineering principles and methods to the elimination and control of hazards. This course covers the following: fundamentals of safety; scientific and engineering bases of safety; safety analysis methods; systems safety; hazards and their control methods; managing safety and health; case studies.

Prerequisite: Fundamental knowledge of engineering and probability & statistics or instructor's consent

Textbook: Instructor's lecture notes

Reference Books:

- Safety and Health for Engineers, 2nd ed. by Roger L. Brauer
- Occupational Safety Management and Engineering, 5th ed. by W. Hammer & D. Price

Course Objectives and Philosophy:

Why safety? For a long time society sought to protect itself from risk. There are several major reasons for safety. The first one is the *humanitarianism*: Our society places high value on human life and welfare. United Nations Universal Declaration of Human Rights states that every employee has the right to work in safe and healthy conditions and employers are required to provide that. The second is the *law*, which is derived from the first. The third one is the *cost*: Society's standards recognize that life and the ability to live it fully has worth. Property, too, has worth. Cost is measured in actual outlays, in avoidance expenditure, or in the value of lost abilities and property.

Where do the engineers and managers stand in safety? Overtime, the role of the engineer has evolved into a complex combination of duties and responsibilities. Modern engineers are required not only to create products and environments, but to make them safe and economical as well. Managers are also required to provide safe and healthy work environments for the employees. Safety Management is a function that enhances company performance by predicting operational, procedural or environmental risks and threats before they occur.

The field of safety engineering has undergone significant change over the past three decades. There are many reasons for this. Some of the more prominent include the following: technological changes that have introduced new hazards in the workplace; proliferation of health and safety legislation and corresponding regulations; increased pressure from regulatory agencies; realization by executives that a safe and healthy workplace is typically a more

productive workplace; health care and workers' compensation costs; increased pressure from environmental groups and the public; a growing interest in ethics and corporate responsibility; professionalization of health and safety occupations; increased pressure from labor organizations and employees in general; rapidly mounting costs associated with product safety and other types of litigation; and increasing incidents of workplace violence.

All of these factors, when taken together, have made the position of the modern safety engineering important than it has ever been. These factors have also created a need for people who will practice as engineers or managers to have the added appreciation and knowledge of how to identify hazards and how hazards may be controlled or eliminated. Safety engineers working with other engineers and managers can form a team of individuals, which will permit industrial and business concerns to operate safely and efficiently and to produce quality goods and services at competitive prices.

Topics:

Part I. INTRODUCTION (1 wk)

1. Need for safety (for engineers, managers and society in general)
2. Fundamental concepts: accidents, occupational diseases and musculoskeletal disorders; accident and health losses; incident and accident theories, preventive strategies
3. Legal, economical and ethical aspects
4. Product liability
5. Safety standards

Part II. SCIENTIFIC AND ENGINEERING BASES OF SAFETY (3 wks)

6. Engineering mechanics and its relationships to safety
7. Basic probability, statistics and statistical distributions
8. Boolean algebra laws
9. Reliability basics
10. Ergonomics principles for safety

Part III. SAFETY ANALYSIS METHODS (2 wks)

1. Failure modes and effect analysis (FMEA)
2. Fault tree analysis (FTA)
3. Hazard and operability analysis (HAZOP)
4. Others

Part IV. SYSTEMS SAFETY (1 wk)

Part V. HAZARDS AND THEIR CONTROL METHODS (4 wks)

1. General principles: Engineering, management and personal protective equipment
2. Noise and vibration
3. Mechanical injuries: falls, impacts, cuts, and others
4. Chemical hazards
5. Biohazards
6. Electrical hazards
7. Fire and fire safety
8. Explosives
9. Pressure hazards
10. Radiation hazards
11. Extreme temperature hazards
12. Ventilation hazards
13. Confined spaces

14. Manual materials handling hazards

15. Case studies for all

Part VI. MANAGING SAFETY AND HEALTH (2 wks)

16. Developing a safety and health program in an organization

17. Promoting the safety culture

18. Hazard communication

19. Planning for emergencies

20. Cost-benefit analysis and decision making in safety

Assignments:

- **Project:** A team of 3 students will analyze an industrial/construction or other process through either observation and/or library research to identify and control/eliminate the hazards associated with the workplace process the student has selected. Hazards are to be documented with photos or other graphics. You will reference at least three safety standards and explain how the associated hazard is significant to your topic. You will recommend a countermeasure (design, safeguard, or administrative control) for each of the three hazards identified. This project will be due to the end of the semester. An oral class presentation is required. The report shall be in both electronic and hard copy format and have these elements:

Title

General description of workplace

Hazards identified (photos and video recordings)

Standards applicable

Suggested countermeasures that can significantly reduce risk for each hazard

Grading:

Midterm: 35%

Final: 40%

Project: 15%

Attendance: 10%

Assignment of grade letters:

85<A≤100; 80<BA≤85; 75<B≤80; 70<CB≤75; 60<C≤70; 55<DC≤60; 50≤D≤55; F<50 (This is tentative. A curving may be performed depending on the class performance).