

BOĞAZIÇI UNIVERSITY

Department of Civil Engineering

Syllabus of CE549 Structural Fire Safety: Theory & Applications



Madrid Windsor Tower



Mandarin Oriental Hotel Fire



LA Interstate Bank Fire



COURSE

Credits

3

Lecture

F 10:00-13:00

Hours

Lecture Hall

M2181

INSTRUCTOR

Name

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Office Hours

W 10:00-11:00

Office

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COURSE TEXTBOOK

- Structural Design for Fire Safety -- Andrew H. Buchanan (in Library E-Reserves)
- Lecture Notes

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OTHER SUPPLEMENTAL MATERIALS

- Steel Structures: Design and Behavior -- Charles G. Salmon, John Edwin Johnson
- Fire Safety Engineering: Design of Structures – J.A. Purkiss (2nd Edition)
- Structural Fire Engineering – Tom Lennon
- Fire Design of Steel Structures ECCS Eurocode Design Manuals – Jean-Marc Franssen, Paulo Vila Real

COURSE DESCRIPTION

The aim of this course is to teach principles of all fire engineering aspects from fire and smoke development to heat transfer, egress and more importantly the underlying mechanics of structural systems. As part of civil engineering program, the class will mainly focus on structural fire behavior. Eurocode design procedures are discussed.

PREREQUISITE

Senior undergraduates as well as any level of graduate students can attend the class.

LABORATORY AND COMPUTER USAGE

Students are encouraged to use software for structural analysis as part of the design problems. Available software are *Ozone* for fire growth and *Elefir* for structural response. The software programs will be supplied by the instructor.

GRADING POLICIES

Participation : 10%
Homework : 25%
Midterm : 25%
Final Exam : 40%

- Attendance policy - Students are expected to attend all the lectures. They are also expected to perform all the work assigned by the instructor.
- Tardy policy - All the assigned work must be submitted by the due date and time. Submissions that are within the next two days will be penalized for 20% of the grade. After 2 days, submissions will neither be accepted nor graded. Exceptions can be made for students with emergencies or special circumstances.
- Make-up policy - Students are expected to take the exams on the assigned dates and times. Make-up exams may be arranged for students with emergencies or special circumstances

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COURSE AND LECTURE OUTLINE

I - INTRODUCTION

Role of structural fire safety engineering, design concerns, regulations, fire precautions during construction, design philosophies, prescriptive approach vs. performance-based approach

II – FIRE EVOLUTION AND GROWTH

Fuels, pre and post-flashover fires, localized fires, design fires, introduction to zone modeling.

III- EGRESS

SFPE guidelines of egress parameters and their interaction with fire and smoke.

IV - HEAT TRANSFER

Fundamentals: Basic definitions and concepts of conduction, natural (gas) convection, ambient radiation

Partial differential equations (PDE): Steady and transient solutions, finite difference formulation

Design methods in heat transfer: section factor, Wickstrom's method in concrete, lumped-mass method in steel

V - MATERIAL PROPERTIES AT ELEVATED TEMPERATURES

Mechanical and thermal changes in steel and concrete: Change in conductivity and specific heat. Reduction rate of yield strength and stiffness, stress-strain curves of Eurocode.

VI - STRUCTURAL FIRE RESISTANCE

Performance-based approach: Isolated member analysis, deflection calculation using virtual work principle, degree of restraints, system analysis using stiffness method.

VII - STRUCTURAL FIRE DESIGN

Eurocode design of tension, bending and compression members, design of beam-columns. estimation of critical temperature and insulation thickness for a given fire rating.