BOĞAZİÇİ UNIVERSITY

Department of Civil Engineering

Syllabus of CE49S SP. TP. FIRE ENGINEERING DESIGN

COURSE	*Credits*	3
	Lecture Hours	WWThTh 5634
	Lecture Hall	ONLINE
INSTRUCTOR	*Name*	Serdar SELAMET
	Email	serdar.selamet@boun.edu.tr
	Phone	+90 212 359 6430
	Office Hours	W 10:00-11:00
	Office	M3310
	Webpage	http://www.structuralfire.com
TEACHING ASSISTANT	Name	TBA
	Email	

COURSE TEXTBOOK

- Structural Design for Fire Safety -- Andrew H. Buchanan
- Lecture Notes

OTHER SUPPLEMENTAL MATERIALS

- Fire Design of Steel Structures ECCS Eurocode Design Manuals – Jean-Marc Franssen, Paulo Vila Real
- NFPA Fire Protection Handbook
- SFPE Handbook

COURSE DESCRIPTION

The aim of this course is to teach principles of all fire engineering design aspects from fire and smoke development to heat transfer, egress and the thermo-mechanical response of structural systems. As part of a civil engineering program, the class will mainly focus on structural fire behavior. Eurocode design procedures will be referenced.

PREREQUISITE

This course is a Design Elective.

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.

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GRADING POLICIES

Homework and Participation	: 20%		- assigned and collected via moodle
2 Midterms	: 20%	(each)	- taken online via zoom.
Final Project	: 40%		- assigned to groups as a take-home

- 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. The instructor should be notified at least 24 hours before the exam date. If not, no make-up exam is made.

CURRICULAR CONTEXT

Throughout the course, basic principles and practical aspects for fire design of structural steel and concrete members will be given according to Eurocode standards. Estimated design content is 75 %.

COURSE OUTCOMES

(1) Learn about fire development and spread mechanisms. Categorize fires as compartment and open fires. Understand the building code approaches to egress and occupant safety.

(2) Understand the basic principles of heat transfer in solids exposed to fire. Learn thermal properties of structural materials.

(3) Analyze the thermal effects on individual structural members and structural systems. Conduct temperature dependent capacity and demand calculations.

STUDENT OUTCOMES

This course is intended to contribute to the following program outcomes:

(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

(2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

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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, degree of restraints, system analysis using stiffness method. Eurocode design of tension, bending and compression members, estimation of critical temperature and insulation thickness for a given fire rating.