ME 374F & 382T

Unique Numbers 18900 & 19065

Fire Science

Fall 2014

Instructor: O.A. Ezekoye

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Office Hours: Tuesday, Wednesday, & Thursday 11:00-noon

Text: J. Quintiere, Fundamentals of Fire Phenomena (Required)

Additional reading assignments may be handed out in class.

Objective: The primary objective of the class is to provide students with an overview of fire physics and tools and to apply this knowledge to typical fire problems. Topics to be covered include:

Combustion Thermochemistry, Combustion Kinetics, Conservation Laws, Flammability Limits, Premixed Flames, Spontaneous Ignition, Liquid Ignition, Solid Ignition, Flame Spread, Diffusion Flames, Burning Rates, Fire Plumes, Compartment Fires, Fire Computer Models (CFAST, FDS, BEHAVE)

Prerequisites for undergrads: thermodynamics, fluid dynamics, heat transfer (or equivalents)

Format:	Lectures MWF 2-3 PM in ETC 2.132	
Grading:	2 term Exams	50 %
	Homework	25 %
	Final Project (no final exam)	20 %
	Participation (Class & UTSFPE)	5%
	(Peer evaluation will factor into final project grade)	

ME 374F & 382T, Fire Science, 2014					
Date		Topic		Reading	Homework
Aug. .	27	**1.** Introduction, Fire Engineering, Fire Timeline, Combustion/Flames/Fires	1	pp 2-17	Hand-out in class
	29	Thermo, Fluids, & Heat Transfer Review	2	19-44	
Sept.	1	**LABOR DAY**			
	3	**2.**, Chem. Balance, Stoichiometry, 1st law, Heat of Combustion (fuel basis), Adiabatic Flame Temperature (AFT)	3		2.4,2.5,2.7,2.8
	5	AFT, Details of Heat of Combustion relationship to Enthalpy of Formation	4		
	8	Gas Mixture Models, Heat of Combustion (O_2)	5		
Travel	10	**3.** Overview of Conservation Laws	6	49-70	2.13, 2.16, 2.18
	12	Energy and Species Conservation	7		
	15	Conservation Examples	8		
	17	Differential Conservation Equations	9		2.33, 2.34. 3.2, 3.6
	19	**4.** Species Eqn and Reaction Kinetics	10	77-109	
	22	Flame Kinetics, Structure, and Conservation Laws	11		
	24	Premixed Flames (Flame Speed), Flammability Limits	12		
	26	Flammability Limit Maps & Quenching,	13		4.2,4.6, 4.16, 4.17
	29	Premixed Flame Examples	14		
Oct.	1	**5.** Auto-Ignition Temperature	15	117-131	
	3	Spontaneous Ignition Theory			
	6	Spontaneous Ignition Examples	16		
Travel	8	**Exam 1**	17		5.2, 5.3, 5.4
	10	**6.** Liquid Ignition Intro	18	135-154	
	13	Flammable Conditions with known Temperature	19		
	15	Coupled Heat and Mass Transfer Theory	20		
	17	Liquid Pool (deep and shallow) Examples	21		
Travel	20	**7.** Solid Ignition (heat transfer time) Theory	22	159-187	6.6, 6.7, 6.8, 6.11
	22	Thermally Thin and Thick Solids	23		
	24	Solid Ignition Analytical Results	24		
	27	Solid Ignition Examples	25		
	29	**8.** Thermal Flame Spread Models	26	191-219	7.5, 7.6, 7.7
	31	Wind aided flame spread	27		
Nov.	3	Opposed flow flame spread	28		
	5	Flame Spread Examples	29		
	7	Flame Spread Examples	30		
	10	**9.** Burning Rate and Diffusion Flame Theory	31	227-285	8.2, 8.5, 8.8
	12	B number Theory	32		
	14	Droplet Evaporation			
	17	Droplet Evaporation Examples	33		
Travel	19	Droplet Combustion	34		
	21	Burning Rate Examples	35		9.1, 9.3, 9.12
	24	**Exam 2**	36		
	26	**10.** Fire Plume Analysis; Ceiling Jets	37	297-332	
	28	**Thanksgiving Break**			
Dec.	1	**11.** Compartment Fire; Smoke Filling of Enclosures	38		
	3	Compartment Fire examples	39		10.2, 10.4, 10.7
	5	Fire Modeling and Discuss Projects	40		
	9	**Final Project Due**			