

FLORIDA STATE COLLEGE AT JACKSONVILLE

COLLEGE CREDIT COURSE OUTLINE

COURSE NUMBER: FES 3103

COURSE TITLE: Fire Dynamics

PREREQUISITE(S): None

COREQUISITE(S): None

STUDENT ADVISING NOTES: Junior Level Status or Above

CREDIT HOURS: 3

CONTACT HOURS/WEEK: 3

CONTACT HOUR BREAKDOWN:

 Lecture/Discussion: 3

 Laboratory:

 Other _____:

FACULTY WORKLOAD POINTS: 3

STANDARDIZED CLASS SIZE ALLOCATION: 30

CATALOG COURSE DESCRIPTION:

This course examines fire dynamics within the context of firefighting and its applications to fire situations, including combustion, flame spread, flashover, and smoke movement, as well as applications to building codes, large-loss fires, and fire modeling

SUGGESTED TEXT(S): Principles of Fire Protection Chemistry, Raymond Friedman, NFPA

IMPLEMENTATION DATE: Fall Term, 2006 (20071)

REVIEW OR MODIFICATION DATE: Spring Term, 2007 (20072)

COURSE TOPICS	CONTACT HOURS <u>PER TOPIC</u>
I. Introduction	3
A. Define fire dynamics	
B. Describe typical compartment fire phenomenology from ignition through fully developed burning	
C. Explain the concept of zones as applied to stratification of gases in a compartment fire	
D. Read and use simple x-y, semi-log, and log-log plots	
E. Identify and evaluate a variable in a correlation	
F. Determine dimensional consistency in equations	
G. Use and understand mathematical functions.	
II. Chemistry, Physical Processes, and Fluid Dynamics	4
A. Balance a chemical equation	
B. Define stoichiometry	
C. Define buoyancy, pressure, and flow	
D. Perform simple radiation, conduction, convection, and heat transfer calculations	
E. Describe the mechanisms of radiation, conduction, and convection in heat transfer	
F. Define what is meant by an energy balance	
G. Calculate the minimum amount of air necessary to burn a given amount of fuel	
H. Define heat of combustion	
III. Fire and Combustion	4
A. Describe the structure of a gaseous, laminar diffusion flame	
B. Define laminar, turbulent, premixed, and diffusion flames	
C. Define flammability limits, and explain each in the context of the structure of a flame	
D. Define heat of combustion, heat of vaporization, and adiabatic flame temperature	
E. Define rate of heat release	
F. Calculate the burning rate of a liquid fuel	
G. Describe the mechanism of solid burning	
H. Describe the burning behavior of upholstered furniture as it relates to furniture calorimeter results	
I. Describe how a cone calorimeter test relates to burning behavior of a solid fuel	

COURSE TOPICS	CONTACT HOURS <u>PER TOPIC</u>
IV. Explosions	4
<ul style="list-style-type: none"> A. Differentiate between deflagrations and detonations on the basis of physical mechanism and damage B. Define the term "explosion" C. Describe three types of explosions D. Calculate the TNT equivalent of a given amount of material E. Relate TNT equivalence to overpressure F. Relate overpressure to damage G. Differentiate between a BLEVE and an UVCE. 	
V. Ignition and Flame Spread	4
<ul style="list-style-type: none"> A. Differentiate between piloted and non-piloted ignition B. Define spontaneous ignition C. Describe the process of flame spread over liquid fuels D. Describe the phenomenology of flame spread over a solid fuel E. List five variables that affect flame spread rate F. Define concurrent and counter flow flame spread G. Explain the importance of thermal inertia in ignition and flame spread 	
VI. Flames and Flame Spread	4
<ul style="list-style-type: none"> A. Calculate the height of a buoyant diffusion flame B. Describe the structure of turbulent, buoyant, and diffusion flames C. Calculate the thermal radiation from a flame D. Define the structure of a buoyant plume and ceiling jet E. List three reasons why plumes are important in fire safety F. Explain the impact of walls and corners on flames and plumes G. Calculate the temperature and velocity of a fire plume H. Describe the interaction between fires and heat detectors 	
VII. Pre-flashover Compartment Fires	4
<ul style="list-style-type: none"> A. List five stages in the fire development process B. Define the relationship between fuel burning rate and compartment temperature C. Calculate the fire gas temperature in a room D. List four heat loss mechanisms in a growing fire E. List five factors affecting the time to flashover in a room F. Define a t^2 fire growth rate G. List five control volumes used to define fire growth in a compartment fire model 	

COURSE TOPICS	CONTACT HOURS <u>PER TOPIC</u>
VIII. Post-flashover Fires	3
<ul style="list-style-type: none"> A. List and describe five energy-loss terms important in post-flashover fire temperature determination B. Define fuel surface and ventilation-limited fires C. Calculate the ventilation-limited burning rate and heat-release rate in a post-flashover fire D. Estimate the post-flashover time-temperature curve for a compartment fire E. Define the concept of excess pyrolyzate 	
IX. Smoke Movement	3
<ul style="list-style-type: none"> A. Define smoke B. Explain how toxic gas production can be determined from a cone calorimeter C. Relate visibility to smoke density D. Describe five forces which act to move smoke in buildings E. Estimate the mechanical ventilation required to maintain a given smoke layer height in an open structure F. Describe four smoke control strategies G. Describe the process of smoke spread in a corridor 	
X. Fire Suppression	3
<ul style="list-style-type: none"> A. Define physical and chemical suppression concepts B. Explain the fire suppression mechanisms of water, CO₂, and Halon 1301 C. List five variables that affect the amount of water required to suppress a fire D. Explain the importance of surface tension in the suppression process of AFFF on liquid pool fires E. Describe three interactions between a water spray and a burning fuel F. Define inerting G. Describe the relationship between fire size, sprinkler actuation time, and suppression; H. Define QRS and ESFR in the context of automatic sprinklers I. Calculate the heat absorption of water in terms of flow rate and heat output of a fire 	

COURSE TOPICS	CONTACT HOURS <u>PER TOPIC</u>
XI. Fire Dynamics Applications to Building Codes and Large Loss Fires <ul style="list-style-type: none"> A. Describe three fire growth processes important in the DuPont Plaza Hotel fire B. Describe the relationship between burning rate, ventilation, and fire spread in the DuPont Plaza and First Interstate Bank fires C. Explain the relationship between building code treatment of fire resistance and post-flashover fire behavior D. Describe the importance of flashover in the First Interstate Bank and DuPont Plaza Hotel fires E. Identify shortcomings in the use of occupancy classification as a measure of fire hazard of a building 	3
XII. Fire Dynamics and Special Hazards <ul style="list-style-type: none"> A. List four variables which affect spontaneous heating and ignition B. Explain why flames in oxygen-enriched atmospheres are hotter than those in air C. List two effects of oxygen-enriched atmospheres on fire behavior D. Explain why post-flashover fire temperatures in the compartment of origin are lower in ships than in buildings and why adjacent spaces reach higher temperatures in ships E. List the factors that affect the pressure rise caused by a compartment fire in a ship compartment F. Describe five variables which affect the behavior of wildland fires G. Explain how flame arresters work H. Describe the predominant fire spread mechanisms in the King's Cross Underground Fire 	3
XIII. Fire Modeling and Trends in Fire Dynamics <ul style="list-style-type: none"> A. Define physical and mathematical fire models B. List and describe five advantages and limitations of mathematical fire modeling C. Explain the differences between zone and field mathematical models D. List three zone-type mathematical fire models E. List three active areas of research in fire dynamics F. Describe two trends in mathematical modeling G. Describe five applications of mathematical modeling 	3



NOTE: Use either the Tab key or mouse click to move from field to field. The box will expand to accommodate your entry.

<i>Section 1</i>		
COURSE PREFIX AND NUMBER: FES 3103		SEMESTER CREDIT HOURS: 3
COURSE TITLE: Fire Dynamics		
<i>Section 2</i>		
TYPE OF COURSE: (Click on the box to check all that apply)		
<input type="checkbox"/> AA Elective	<input type="checkbox"/> AS Required Professional Course	<input type="checkbox"/> College Prep
<input type="checkbox"/> AS Professional Elective	<input type="checkbox"/> AAS Required Professional Course	<input type="checkbox"/> Technical Certificate
<input checked="" type="checkbox"/> Other <u>BAS Required Professional Course</u>		
<input type="checkbox"/> General Education: (For General Education courses, you must also complete Section 3 and Section 7)		
<i>Section 3 (If applicable)</i>		
INDICATE BELOW THE DISCIPLINE AREA FOR GENERAL EDUCATION COURSES:		
<input type="checkbox"/> Communications	<input type="checkbox"/> Social & Behavioral Sciences	<input type="checkbox"/> Mathematics
<input type="checkbox"/> Natural Sciences	<input type="checkbox"/> Humanities	
<i>Section 4</i>		
INTELLECTUAL COMPETENCIES:		
<input checked="" type="checkbox"/> Reading	<input type="checkbox"/> Speaking	<input checked="" type="checkbox"/> Critical Analysis
<input checked="" type="checkbox"/> Quantitative Skills	<input checked="" type="checkbox"/> Scientific Method of Inquiry	
<input type="checkbox"/> Writing	<input checked="" type="checkbox"/> Listening	<input type="checkbox"/> Information Literacy
<input type="checkbox"/> Ethical Judgment	<input checked="" type="checkbox"/> Working Collaboratively	
<i>Section 5</i>		
	LEARNING OUTCOMES	METHOD OF ASSESSMENT
• 1	read and use simple x-y, semi-log, and log-log plots	exam
• 2	define stoichiometry	exam
• 3	define heat of combustion, heat of vaporization, and adiabatic flame temperature	exam
• 4	calculate the TNT equivalent of a given amount of material	exam
• 5	calculate the thermal radiation from the flame	exam
• 6	list five stages in the fire development process	exam
• 7	calculate the ventilation-limited burning rate and heat-release in a postflashover fire	practical application inside burn building
• 8	define physical and chemical suppression concepts	exam
• 9	describe three fire growth processes important in the DuPont Plaza Hotel fire	exam
• 9	list four variables which affect spontaneous heating and ignition.	exahm
<i>Section 6</i>		
Name of Person Completing This Form: Richard Nelson		Date: 8-23-05