ME 432 COURSE PROFILE

DEGREE PROGRAM: Mechanical Engineering

<table>
<tr><td>COURSE NUMBER: ME 432</td><td>COURSE TITLE: Combustion</td></tr>
<tr><td>REQUIRED COURSE OR ELECTIVE COURSE: Elective</td><td>TERMS OFFERED: Fall</td></tr>
<tr><td>TEXTBOOK / REQUIRED MATERIAL:</td><td>PRE / CO-REQUISITES: MECHENG 336, preceded or accompanied by MECHENG 320. II (3 credits)</td></tr>
<tr><td>COGNIZANT FACULTY: A. Atreya</td><td rowspan="2">COURSE TOPICS:

1. Combustion thermochemistry
2. Reaction kinetics & equilibrium
3. Combustion transport
4. Premixed combustion
5. Diffusion flames
6. Turbulent flames
7. Emissions
8. Applications of combustion</td></tr>
<tr><td>BULLETIN DESCRIPTION: Introduction to combustion processes; combustion thermodynamics, reaction kinetics, and combustion transport. Chain reactions, ignition, quenching, and flammability limits. Detonations, deflagrations, and flame stability. Introduction to turbulent premixed combustion. Applications in IC engines, furnaces, gas turbines, and rocket engines.</td></tr>
<tr><td colspan="2">COURSE STRUCTURE/SCHEDULE: Lecture: 2 days per week at 1.5 hours</td></tr>
</table>

COURSE OBJECTIVES: **for each course objective, links to the Program Outcomes are identified in brackets.**	1. To review and confirm the basic principles of combustion thermodynamics [1] 2. To teach how to compute the adiabatic flame temperature when there is dissociation of the chemical products [1, 6, 7] 3. To present the complexity and difficulty associated with the chemical kinetics of both individual and multi-component chain reactions [1, 7] 4. To introduce the phenomena of combustion transport [1, 7] 5. To teach the elementary theory of premixed flames [1, 6] 6. To teach the basic elements of diffusion flames [1, 6] 7. To introduce combustion emissions [1, 2, 4, 7] 8. To provide exposure to a variety of combustion systems [1, 2, 4, 7]
COURSE OUTCOMES: **for each course outcome, links to the Course Objectives are identified in brackets.**	1. Compute adiabatic flame temperatures of multi-component gas mixtures with dissociation of the products [1, 2] 2. Given the temperature, use tabulated Arrhenius reaction rates to determine which of a number of reactions is proceeding most rapidly [3] 3. Given one measured laminar flame speed, predict flame speeds at other conditions for the same primary reaction [4, 5] 4. Given the initial mixture properties, estimate the speed and pressure of a detonation wave [5] 5. Know the main differences between laminar and turbulent combustion [4, 5, 6] 6. Know the main differences between premixed and diffusion flames [5, 6] 7. Know the basic temperature-performance-emissions trade-offs made in designing commercial combustion systems [7, 8] 8. Given the heating load and fuel composition, size an appropriate combustion system [4, 8]
ASSESSMENT TOOLS: **for each assessment tool, links to the course outcomes are identified**	1. Regular homework problems 2. Exam(s) and/or project (s)

PREPARED BY: A. Atreya
LAST UPDATED: 06/08/2011