EME 432 Internal Combustion Engines 3 Credits

Instructor: Professor Horizon Gitano

Objectives:

The students should attain a fundamental understanding of the function of modern Internal Combustion Engines, including identification of each major component, knowledge of its function and how it relates to the other components in the engine. The student should also understand the basics of combustion chemistry, thermodynamics and heat transfer as applied to an ICE. Calculations of torque, power, efficiency, air/fuel ratio and fuel consumption will be required of students in the course. Finally an understanding of various new technologies in engine controls and their relations to fuel economy, vehicle dynamics, cost and emissions will be required.

Primary Text Book:

John B. Heywood, "*Internal Combustion Engine Fundamentals*", McGraw-Hill

Additional Reference Books:

Willard W. Pulkrabek, "*Engineering Fundamentals of the Internal Combustion Engine*", 2nd Edition, Pearson Prentice Hall

Eastop, T.D. and McConkey, A., "*Applied Thermodynamics for Engineering Technologies*", 5th edition, SI Units, Longman Publication, 1994

Winterbone, D.E., "*Advanced Thermodynamics for Engineers*", Arnold, 1997

Benson, R.S. & Whitehouse, N.D., "*Internal Combustion Engines*", Vol. 1-2, Pergamon, 1983

Grading:

Final Exam:		50%	
Course Work:			
Tests (2-3)		30% Total	(Tests will be in normal classroom)
Homeworks (10)	2% each	20% Total	(HWs due 1 week from assignment date)

NOTICE:

The following is the percentage breakdown of the letter grades:

A 90 to 100%

B 80 to 89.9%

C 70 to 79.9%

D 60 to 69.9%

F Below 60%

TO PASS THIS CLASS **YOU MUST PASS BOTH THE COURSE WORK AND FINAL EXAM**!

F + A = F F + B = F F + C = F F + D = F

Also Note: **PLAGIARISM = FAIL**. If you are caught copying you will fail the class.

Course Outline (Chapter numbers refer to Heywood):

Week 1	Introduction: OBE and Expected Outcomes
CH1	History of ICEs, Engine Classification
	Fundamentals of Internal Combustion Engines
	Slider-Crank Mechanism, Bore, Stroke, CR
Week 2	Chemistry: Air Fuel Mixtures, Atomic Balance, Heat
CH2-3	AFR, Equivalence Ratio and Exhaust Products
Week 3-4	Idealized Cycles: Compression, Expansion and Heat addition
CH4-5	Thermodynamics of Four Stroke Engines
	Thermo of Two Stroke Engines
	Torque, speed, Power, Overall Power Calculation
	Break Mean Effective Pressure, BSFC
	TEST #1
Week 5-6	Fuel Mixing Techniques and Fuel Droplet Vaporization
CH9	Spark Ignition Engines: Carburetors, Fuel Injection, Direct Injection
	Ignition Systems, Ignition Energy, Combustion Stability
CH10	Compression Ignition: Direct Injection, Indirect Injection
Week 7	Gas Exchange process and Volumetric Efficiency
Week 8-9	Turbulence and Flame Speed
CH7-8	In-Cylinders Bulk Flows
	Flame Propagation
CH9	Abnormal Combustion: Knock, HCCI
CH6, 13	Friction
	TEST #2
Week 11-12	Performance, Economy and Emissions
	Valve Timing
	Intake/Exhaust Tuning
CH11	Exhaust Gas Recirculation
CH15	Super/Turbo Charging
	Pollution and Catalysts
Week 13-14	Electronic Engine Controls: Sensors, Actuators
	Dynamometry: Engine Testing and Measurements
	Hybrid Vehicle Systems: Parallel-Series, Power and Energy
	Alternate Fuels: Costs, Advantages and Disadvantages
	TEST #3

Review for Final Exam