COURSE NUMBER: ME 5462, 4 credits	**COURSE TITLE:** Gas Turbines
TERMS OFFERED: Fall	**PREREQUISITES:** Thermodynamics, Fluid Mechanics (ME 3331, 3332), IT upper division or Grad student.
TEXTBOOKS/REQUIRED MATERIAL: "Elements of Gas Turbine Propulsion," by J.D. Mattingly, 1996, McGraw-Hill, Inc. "Fundamentals of Gas Turbines," by W.W. Bathie, 2^{nd} Ed., 1996, John Wiley & Sons.	**PREPARED BY:** Paul J. Strykowski **DATE OF PREPARATION:** May 2007
COURSE LEADER(S): P.J. Strykowski	**CLASS/LABORATORY SCHEDULE:** Four 50-minute sessions per week **CONTRIBUTION OF COURSE TO MEETING PROFESSIONAL OBJECTIVES:** 100% Engineering topics
CATALOG DESCRIPTION: Gas turbine cycles, regeneration, reheat, intercooling, combined cycle plants, and thermochemical regeneration. Axial and radial flow compressors and turbines; combustor designs, energy analysis. Turbojet, fanjet, turboprop engine performance.	**COURSE TOPICS:** 1. Review of thermodynamics & fluid mechanics. 2. Balance principles of mass, momentum, energy and entropy for gas systems. 3. Introduce sound speed and Mach number. 4. Introduce concept of stagnation state of a fluid 5. Develop basic thermodynamic cycle analysis for gas turbine engines. 6. Evaluate the role of regeneration, reheat, and intercooling on cycle performance. 7. Develop thrust equation; examine the performance of turbojet, turbofan, turboprop and ramjet engines. 8. Fluid mechanics of rotating machinery; velocity-vector diagrams — related work and energy expressions. 9. Stage calculations for compressors and turbines. 10. Performance of compressors, combustors, turbines, nozzles & diffusers 11. Off design performance considerations 12. Component matching 13. Film cooling, secondary flow, pumping losses; system integration issues.

COURSE OBJECTIVES	1. Apply mass, momentum, energy and entropy balances to compressible gas systems relevant to gas turbine engines. 2. Apply thermodynamic properties to evaluate gas turbine and compressor performance, with a strong emphasis on T-s property plane representations. 3. Develop fundamentals of compressible flow to address choking and shocks as pertinent to gas turbine engine performance. 4. Develop understanding of gas turbine cycle analysis, including the physical significance of intercooling, reheat, recuperation, maximum system temperature, pressure ratio, and system inefficiencies for stationary power applications. 5. Develop understanding of performance of basic propulsion gas turbine engines, including: turbojets, turbofans & props, and ramjets. 6. Apply velocity-vector diagrams to analyze the fluid mechanics of rotating machinery including compressors and turbines. 7. Apply knowledge of compressors, turbines and combustors to match and design gas turbine engine components and systems.
COURSE OUTCOMES	**(Letters shown in brackets are linked to program outcomes a-k)** 1. Demonstrate the application of mass, momentum, energy and entropy balance principles applied to ideal gas systems with constant and variable specific heats [a, e] 2. Understand the importance of gas turbine cycle analysis beginning with the basic Brayton cycle and incorporating intercooling, reheat, regeneration, afterburning, etc. [a, e, k] 3. Apply compressible gas dynamics to subsonic and supersonic nozzle design relevant for gas turbine exhaust systems [a, c, e, h, k] 4. Apply thermochemistry of complete and incomplete reactions, as well as principles of choking due to heat addition, to design basic gas turbine combustors. [a, c, e, h, k] 5. Apply conservation of angular momentum to analyze velocity-vector diagrams of compressors and turbines. Represent stage and system performance in the T-s property plane [a, e] 6. Understand importance of and limitations to gas turbine engine performance imposed by system irreversibility [a, c, h] 7. Apply thermodynamic and fluid mechanics principles to the matching of turbine and compressor components [a, b, c, e, h, k]
ASSESSMENT TOOLS:	1. Exams (2-3 midterm exams; final exam) 2. In class problems & discussion 3. Extensive homework problem sets (emphasis on computer solutions)

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Nature of changes:
The Thermodynamics and Heat Transfer division discussed the curricular content of Gas Turbines, ME 5462. No major changes were introduced, though it was with the understanding that students would use computational tools to study the fundamentals of gas turbine performance rather than commercial codes for gas turbine design.