COURSE NUMBER: ME 5351, 4 credits	**COURSE TITLE:** Computational Fluid Dynamics and Heat Transfer
TERMS OFFERED: Spring	**PREREQUISITES:** Fluid Dynamics (ME 3332 or equivalent), Heat Transfer (ME 3333 or equivalent), IT upper division or Grad student.
TEXTBOOKS/REQUIRED MATERIAL: Hoffman, K.A. and Chiang, S., *Computational Fluid Dynamics for Scientists and Engineeers*, Engineering Education System, 1998.	**PREPARED BY:** Sean C. Garrick **DATE OF PREPARATION:** May 2007
COURSE LEADER(S): S. C. Garrick	**CLASS/LABORATORY SCHEDULE:** Two 1 hour, 50 minute lectures per week. **CONTRIBUTION OF COURSE TO MEETING PROFESSIONAL OBJECTIVES:** 100% Engineering topics
CATALOG DESCRIPTION: Application of computer analysis to engineering design of fluid/thermal systems will be emphasized. The general governing equations and brief survey of methods to solve them will be presented. Students are responsible for writing computer programs to solve problems involving steady and unsteady conduction and fully developed flows and heat transfer in channels. Introduction to the use of state-of-the-art computer tools for analysis and graphical representation resulting in a broad view of computational fluid mechanics for engineering applications in the fluid/thermal sciences.	**COURSE TOPICS:** 1. Numerical Methodology 2. Finite-Difference (major emphasis). 3. Finite-Element. 4. Spectral Methods. 5. Implementation of Numerical Methods 6. Ordinary Differential Equations. 7. Partial Differential Equations. 8. Specification of Mathematical Boundary Conditions. 9. Numerical Analysis 10. Stability, convergence and accuracy. 11. Fluid Mechanics & Heat Transfer 12. Control Volumes and Systems. 13. Solution of Navier-Stokes Equations 14. Solution of the Energy Equation. 15. Convective Heat Transfer. 16. Conductive Heat Transfer. 17. Non-linear Transport Phenomena. 18. Introduction to Turbulent Flow.

COURSE OBJECTIVES	Ensure that students have a strong understanding of the following: 1. Numerical Methods, Analysis & Visualization. 2. Advanced Fluid Mechanics & Heat Transfer. 3. Applied Mathematics. 4. Computational Transport Phenomena.
COURSE OUTCOMES	**(Letters shown in brackets are linked to program outcomes a-k)** 1. Demonstrate the application of mass, momentum, and energy conservation principles applied to systems of real fluids [a, c, e]. 2. Demonstrate the application energy conservation principles applied to solids with temperature dependent thermal conductivities [a, c, e]. 3. Understand importance of and limitations numerical methods in the obtaining solutions of systems of partial differential equations [e, k]. 4. Understand and demonstrate the effects and limitations of specifying numerical/mathematical boundary conditions [a, c, e]. 5. Demonstrate the ability to construct, and numerically simulate a computational equivalent of a experiment [b, g]. 6. Obtain numerical solutions of the non-linear conservation equations where analytical solutions are unobtainable [h, j].
ASSESSMENT TOOLS:	1. Six (6) Projects 2. In class problems & discussion 3. Extensive homework problem sets

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Nature of changes:
Dr. Garrick reviewed this document in May, 2007 and no changes were made.