UNIVERSITY OF CALIFORNIA
UCMERCED

Syllabus for ME254-01: Computational Fluid Dynamics

Spring 2019
Instructor: Venkattraman Ayyaswamy

Designation:	Graduate
Catalog Description:	Fundamentals of computational theory and computational methods. The first part covers material fundamental to the understanding and application of numerical methods. The second part illustrates the use of such methods in solving different types of complex problems encountered in fluid mechanics and convective heat transfer.
Text Books and Other Required Materials:	Reference books (Not required) 1. R. H. Pletcher, J. C. Tannehill, and D. A. Anderson, ``Computational Fluid Mechanics and Heat Transfer", 3rd edition, 2013. 2. J. H. Ferziger and M. Peric, ``Computational Methods for Fluid Dynamics", 3rd edition, 2002. 3. H. K. Versteeg and W. Malalasekara, ``An Introduction to Computational Fluid Dynamics: The Finite Volume Method", 2nd edition, 2007.
Course Objectives/ Student Learning Outcomes:	Upon successful completion of this course, students will develop a fundamental understanding of the various numerical techniques used in computational fluid dynamics; assess the accuracy of the obtained numerical solution; develop their own programs for solving problems encountered in fluid mechanics and heat transfer.
Program Learning Outcomes:	
Prerequisites by Topic:	
Course Policies:	
Academic Dishonesty Statement:	a. Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy. Any work submitted by a student in this course for academic credit will be the student's own work. b. You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e mail, an e mail attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action. c. During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the

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	course and University disciplinary action.
Disability Statement:	Accommodations for Students with Disabilities: The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations.
Topics:	1. Introduction: General Remarks; Partial Differential Equations and their physical, mathematical classifications. 2. Basics of Discretization Methods: Introduction; Finite differences; Difference representation of PDEs; Finite Volume Method; Stability Considerations (von Neumann Analysis). 3. Application of Numerical Methods to Model Equations: Description of various numerical methods in the context of Wave Equation; Heat Equation; Laplace's Equation; Inviscid and Viscous Burgers' Equation. 4. Governing Equations of Fluid Mechanics and Heat Transfer: Fundamental Equations; Averaged Equations for Turbulent Flows; Introduction to Turbulence Modeling; Euler Equations and Boundary-Layer Equations. 5. Numerical Methods for Inviscid Flow Equations: Introduction; Method of Characteristics; Shock-Capturing Methods; Flux and Flux-Difference Splitting Schemes. 6. Numerical Methods for Navier-Stokes Equations: Compressible Navier-Stokes Equations; Incompressible Navier-Stokes Equations (Vorticity-Stream Function Approach, Pressure-Correction Approach including SIMPLE family and PISO method)
Class/laboratory Schedule:	TR 9:30 - 11:20 am
Midterm/Final Exam Schedule:	TBA
Course Calendar:	
Professional Component:	
Assessment/Grading Policy:	Homeworks: 20% Mid-term Exam 1: 25% Mid-term Exam 2: 25% Final Exam: 30%
Coordinator:	Venkattraman Ayyaswamy
Contact Information:	Office: SE2 278 Phone: (209) 228 2359 Email: vayyaswamy@ucmerced.edu
Office Hours:	TR 4:00 pm to 5:30 pm or by appointment