Università degli Studi della Basilicata
Scuola di Ingegneria

COURSE: Fluid Mechanics for Internal Combustion Engines and Turbomachinery				
INSTRUCTOR: Annarita Viggiano				
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Language: Italian				
ECTS: 9	n. of hours: 81	Academic year: 2014/2015	Campus: Potenza	Spring Semester

TOPICS
Mathematical models for the study of turbulent reacting flows in fluid machinery.
Numerical schemes for computational fluid dynamics.
Applications to design and analysis of fluid machinery.

TEACHING METHODS
x Theoretical lessons
x Tutorials in classroom
x Tutorials in laboratory
☐ Project works
☐ Technical visits

TEXTBOOKS
1. D.C. Wilcox, Turbulence Modeling for CFD, Dcw Industries, 2006.
2. J.C. Tannehill, D. A. Anderson, R. H. Pletcher, Computational Fluid Mechanics and Heat Transfer, Taylor & Francis, 1997.
3. J.D. Anderson, Modern Compressible Flow: with Historical Perspective, McGraw-Hill, New York, 2002.
4. J.B. Heywood, Internal Combustion Engine Fundamentals, McGraw–Hill, New York, 1988.
5. Instructor's notes.

ON-LINE EDUCATIONAL MATERIAL
web address: http://oldwww.unibas.it/utenti/viggiano/viggiano.htm

LEARNING OUTCOMES
The purpose of this course is to provide the fundamentals of fluid dynamics, as applied to fluid machinery, and of Computational Fluid Dynamics (CFD) and to introduce students to the use of CFD for fluid machinery design and analysis .

REQUIREMENTS

EVALUATION METHODS
☐ Intermediate verifications
☐ Written examination
x Discussion of a project work
☐ Practical test
x Oral examination

DETAILED CONTENT
Fundamentals of fluid dynamics: conservation equations. Compressible and incompressible flows. Multicomponent mixtures flows. Introduction to turbulence. Energy cascade and dissipation at small scales. Kolmogorov's universal equilibrium theory. Kolmogorov scales. Direct numerical simulation of turbulence. Reynolds averaged Navier-Stokes equations. Turbulence models: algebraic models, one-equation models, two-equation models. Favre averaged equations. Introduction to LES and DES.
Computational fluid dynamics. Classification of PDE. Equilibrium problems and marching problems. Finite differences. Accuracy, consistency and stability of a numerical scheme. von Neumann analysis. Amplification factor. Modified equation: dissipation, dispersion and diffusion errors. Definition of convergence: Lax's equivalence theorem. Application of numerical schemes to the model equations. Finite volume methods. Computational grids. Initial and boundary conditions.
Applications of CFD to the design and analysis of internal combustion engines by using open source software.

SEMINARS BY EXTERNAL EXPERTS YES ☐ NO x

FURTHER INFORMATION