UNIVERSIDADE FEDERAL DO PARANÁ
SETOR DE TECNOLOGIA
DEPARTAMENTO DE ENGENHARIA MECÂNICA

Title of Module:	**COMPUTATIONAL HEAT AND MASS TRANSFER**
Code:	**TME7065**
Total time:	60 hours
Credit points:	4
Level:	MSc and PhD
Prerequisite:	none
Co-requisite:	none

AIMS:
Enable the student to solve nonlinear physical problems modeled by partial differential equations through the Finite Element Method (FEM).

SYLLABUS:
Linear Problems Review: the finite element method in heat conduction and linear elasticity; Navier-Stokes, Euler, Energy and Concentration Equations: study of nonlinearities; boundary and initial conditions. Formulation through the Finite Element Method (FEM): mesh generation; mixed and penalty models; computational considerations for the calculation of elementar matrices; the pressure calculation; satisfaction of entropy conditions. Iterative Methods for Nonlinear Equations: Picard, Newton, modified Newton, quasi-Newton, continuation methods, pressure prediction/correction methods. Time Approximation Schemes: explicit and implicit methods. Non-Newtonian Fluids: inelastic and visco-elastic fluids. Numerical Examples: solution of several nonlinear problems.

BIBLIOGRAPHY:
- Reddy, J.N.and Gartling, D.K., The Finite Element Method in Heat Transfer and Fluid Dynamics, CRC Press, Boca Raton, FL, 1994.
- Zienkiewicz, O.C., and Taylor, R.L., The Finite Element Method,4th Edition., Vols.1 and 2, McGraw-Hill, 1989-91.
- Hirsch, C, Numerical Computation of Internal and External Flows, Vols. 1 and 2, Wiley, 1988.
- Hughes, T. J. R., 1987, The Finite Element Method: Linear Static and Dynamic Finite Element Analysis, Prentice-Hall.

RESPONSIBLE CO-ORDINATOR:
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