Review before first exam - What you should know?

Chapters 0

- Approaches for studying fluid dynamics
- Characteristics of CFD as compared to other approaches of studying fluid dynamics
- Key components of computers
- Basic computer architectures – differences, pros and cons
- Memory hierarchy
- Current trend in moving toward distributed memory massively parallel systems
- Shared-memory versus distributed memory parallelization
- Concepts of scalar, vector, superscalar, pipelining
- Vectorization and parallelization issues
- Amdahl's Law – its derivation and application.
- Code optimization issues

Chapters 1

- ODE versus PDE
- Order and linearity of PDE's
- Classification of first-order, second-order PDE's and systems of first-order PDE's
- Three canonical forms of 2nd-order PDE's.
- Conversion of 2nd-order PDE in a general form into one of the three canonical forms via coordinate transformation.
- Classification of PDE's according to the existence of characteristics
- Be able to derive the characteristics and compatibility equations for first and second order PDE's and systems of first-order PDE's
- Can use method of characteristics to solve simple problems
- Concepts of domain of dependence (DOD) and domain of influence
- Main characteristics of the DOD for hyperbolic, parabolic and elliptic equations
- Basic types of I.C. and B.C.
- Know something about the well-posedness of PDE systems

Chapters 2 (through section 2.3.5)

- User Taylor series expansion or polynomial fitting methods to derive finite difference approximations
- Be able to derive and discuss truncation errors
- The order of accuracy of F.D. schemes
- The concepts of consistency, stability and convergence, Lax’s equivalence theorem
- Numerical convergence and identification of numerical order of accuracy.
- Methods for determining stability of F.D. schemes
- Be able to perform stability analysis using von Neumann method