Foundation of Computational Fluid Dynamics
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Lecture - 43
Conclusion

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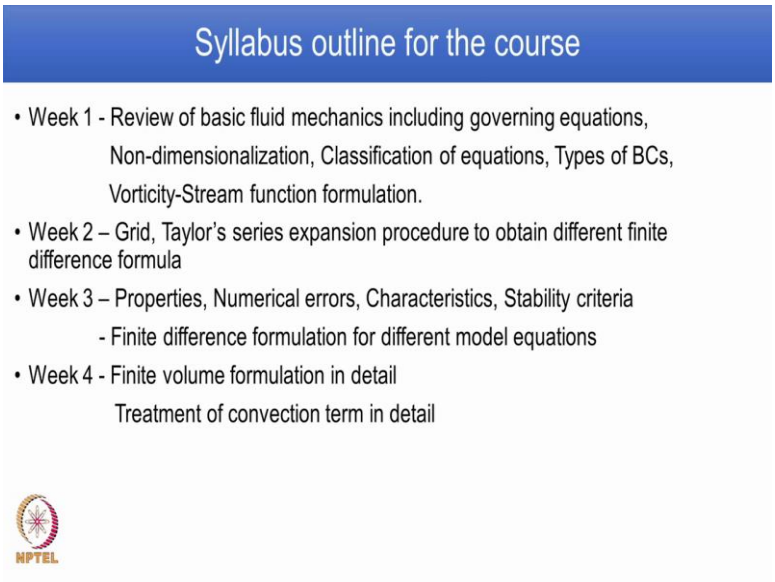

It is my pleasure to greet you again. This is the concluding lecture on for the entire course. In this concluding lecture, I want to overview what all we have done week-by-week; on that way you will have the overall picture of the course. In week 1, we did review of the basic fluid mechanics including governing equation, non-dimensionalization ,classification of equations PDEs, type of boundary condition and then we derived vorticity-stream function equation. In week 2, we spend time on grid then we started going to the Taylor's series of expansion; from Taylor's series of expansion, we got different finite difference formula, first order, second order, forward, backward, central, higher order, uniform mesh and non-uniform mesh.

In week 3, explained different properties conservativeness, boundariness, transportiveness. Then numerical errors and characteristics associated with finite difference scheme in terms of consistency, conservativeness, stability and lack equivalence theorem. We explained all these with the help of example problem. We also gave different assignments based on this. Then we also explained finite difference equations for different model equations and explained for those examples different

properties. Week 4, was a main subject; we started talking about finite volume formulation in detail. So, we have talked in detail about convective terms, non-linearity associated with convective term, how to treat convective term exclusively. We had different approximation procedure; we explained all of them with the help of the corresponding formula in detail. Then we also took an example problem and variation in the example problem, and performed explained the performance of these schemes and illustration explaining how same schemes behaves differently for different numerical condition.

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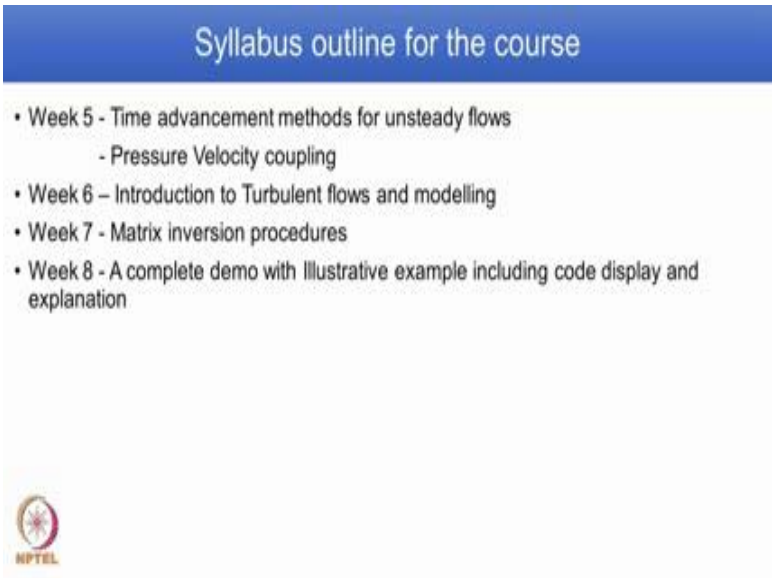

Week 5, the time integration procedure, where we talked about different time integration methods available and comparison of them explicit formulation, implicit formulation and how to construct any higher order methods for time discretization as well. Then we moved on to what is known as the pressure-velocity coupling method. We learnt pressure does not have the separate equation, but somehow we have to link between momentum equation and mass equation. We had explained three four procedures – SIMPLE, MAC and then projection method.

In week 6, we talked in detailed about the turbulent flows, characteristics of turbulent flows, modeling of these equations, and different models available, advantages and some applications. We also gave different assignments based on whatever explained in this module. In week 7, is dedicated for matrix inversion procedures. Whatever method we

follow for discretization finite difference, finite volume or finite element method finally, they will end up with the form of the matrix equation. So, we have to know how to invert them. And there are different methods available direct method and iterative methods. And in direct methods, we listed three examples Gauss elimination method, L U decomposition, and Thomas algorithm for tridiagonal matrix algorithm. Similarly in the iterative method, we explained many methods Gauss-Siedal method then S O R methods. We also talked about what is known as the pre conditioner, ill condition of a matrix and pre conditioner, different preconditioning procedure available.

And putting together all of them we had in 8th week. A working code problem considered was flow in a lid driven cavity, and then we explain numerical algorithm step-by-step, using the projection step method, then corresponding code working code was displayed and line-by-line of that code was explained. Then at the end of it we have the complete code then actual running of the code, and the results obtained everything was explained in detail. We believe this as created interest in you, you also believe this as created some confidence in you. We wish that you continue your interest and learn more and more.

Thank you.