

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. SEMESTER: V

AERONAUTICAL ENGINEERING

Subject Name: Computational Fluid Dynamics - I

Subject Code: **150104**

Teaching Scheme				Evaluation Scheme		
Theory	Tutorial	Practical	Total	University Exam (Theory) (E)	Mid Sem Exam (Theory) (M)	Internal Assessment (I)
3	0	2	5	70	30	50

Sr. No.	Course Content
1.	<p>Philosophy of Computational Fluid Dynamics: Introduction to CFD, CFD- a research tool, CFD- a design tool, Applications and advantages of CFD, The basic governing fluid flow equations in differential form, Models of fluid flow, Concept of substantial derivative, Navier-Stoke's model and Euler's model of equations, Generic form for CFD.</p>
2.	<p>Mathematical Behavior of Partial Differential Equations: Introduction, Classification of quasilinear partial differential equations, Methods of determining classification of PDEs. Hyperbolic, Parabolic and elliptic behavior of equations, Well posed problems, Boundary conditions for viscous and inviscid fluid flows.</p>
3.	<p>Basic Discretization Techniques: Introduction to grid generation, Need to discretize the domain, Finite difference, Finite element and finite volume methods to discretize the domain, Difference equations, Implicit and explicit methods, Errors and analysis of stability, Grid with transformations, Metrics and Jacobians, Compressed grids, Adaptive grids, Elliptic grid generation.</p>
4.	<p>Analysis of Numerical Schemes: Numerical approach to solve fluid flow equations, Lax Wendroff method, Richtmyer method, Linear and nonlinear scheme, Stability and convergence, Maccormark's technique to solve PDEs.</p>
5.	<p>Applications of Cfd to Steady Subsonic Flow Through Nozzle: Introduction to flow through subsonic flow through nozzle, Problem definition, Basic governing fluid flow equations in non linear, Linear and nondimensional form, Generic form of governing equations suited to Maccormark's technique, Initial and boundary conditions, Concept of characteristic lines, Application of Maccormark technique to 1-D nozzle problem.</p>

Reference Books:

1. Computational fluid dynamics–Basics with applications :J.D.Anderson
2. Computational fluid dynamics :T.J.Chung
3. Fundamentals of computational fluid dynamics: T.K.Sengupta
4. Computational methods for fluid dynamics: J.H.Ferziger, M.Peric, springer