GUJARAT TECHNOLOGICAL UNIVERSITY
B. E. SEMESTER: V
AERONAUTICAL ENGINEERING

Subject Name: **Computational Fluid Dynamics**
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.	**Philosohy 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, Navior-Stoke's model and Euler's model of equations, Generic form for CFD.
2.	**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 viscid and inviscid fluid flows.
3.	**Basic Descretization Techniques:** Introduction to grid generation, Need to descretize the domain, Finite difference, Finite element and finite volume methods to descretize 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.
4.	**Anlaysis of Numerical Schemes:** Numerical approach to solve fluid flow equations, Lax Wendroff method, Richmyer method, Linear and nonlinear scheme, Stability and convergence, Maccormark's technique to solve PDEs.
5.	**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-Dnozzle problem.

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