Course Outline

Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NCED504	Computational Fluid Dynamics in Civil Engineering	3	0	0	3

Course Objective

The course focuses on the providing fundamental understanding on the computational and numerical techniques for the solution of flow equations.

Learning Outcomes

Upon successful completion of this course, the students should be able to:

- To develop fundamental understanding on approaches and techniques in Computational Fluid Dynamics
- To gain experience in using Finite Difference and Finite Volume techniques for solving CFD problems
- To develop skills for the numerical implementation of CFD techniques

Unit No.	Topics to be Covered	Contact Hours	Learning Outcome
1	Introduction to Computational Fluid Dynamics, Derivation of Governing Equations, Classification of Partial Differential Equations and Physical Behaviour	6L	• Understanding fluid flow equations • Thorough idea of PDEs
2	Fundamentals of Finite Difference/ Finite Element/ Finite Volume methods, Finite difference Approximations for Solving PDEs, Concept of Discretization, Steady and Unsteady Problems, Boundary and Initial conditions	8L	• Understanding on the computational approaches • Basics of Finite Difference • Concept of discretization
3	Finite difference Approximation of One-dimensional Steady and Unsteady Flow Equations, Explicit and Implicit Approaches, Time marching Methods, Error Analysis, Concept of Consistency, Convergence and Stability	10L	• Illustration of Finite Difference for solving CFD problems • Error and Stability analysis of numerical schemes
4	Finite volume method, Grid generation, Illustrative examples, Solution of system of linear and non-linear Algebraic system, Simple and advance	13L	• Understanding of Finite Volume method • Solution of system of
	methods, Introduction to Turbulent Flows and Turbulent Modelling		Algebraic equation • Basics of Turbulence modelling
5	Application of CFD in Civil Engineering, Illustrative examples using code implementation/ CFD packages	5L	• Application in Civil Engineering problems
	Total Contact Hours	**42L**	

Text Books:

1. Anderson, J. D. JR. (1995). "Computational Fluid Dynamics. The Basics with Applications".McGraw-Hill Education.
2. Chung, T.J. (2002) "Computational Fluid Dynamics", Cambridge University Press

References

1. Warsi, Z.U.A. (2005) "Fluid Dynamics-Theoretical and Computational Approaches",3rd Edition,CRC Press Approaches.
2. Versteeg H.K. and Malalasekera W. (2007). "An Introduction to Computational FluidDynamics", 2nd edition, Pearson Prentice Hall.
3. Peyrate R. and Taylor T.D. (1990). "Computational Methods for Fluid Flow". Springer Publications.

Summary of Updated Course Plans submitted

Name of the Department - _____

Summary of Existing Courses with nature of updates/changes made						
S.No.	**Course Code**	**Course**	**Name of the**	Done only	Whether	Nature of

	(Write Both Existing and New, if the course code is changed)	**Type** (Write Both Existing and New, if the course type is changed)	**Course** (Both Existing and New, if name is changed)	the expansion of existing course content to 14 weeks with no change in course content or course credits (Yes / No)	Offered for NEP regime or CBCS/Existing students?	Updates / Changes made in course content, if any (Other than expansion of existing content to 14 weeks)
1	**Existing:CED502 New: CED502**	**Existing: DE New: DE**	**Computational Fluid Dynamics in Civil Engineering**	**Yes**	**NEP**	**NA**

Summary of Fresh Courses proposed for NEW regime of NEP

S.No.	Course Code (Also the Old Course Code, if similar to an old course)	Course Type	Name of the Course	Offered for UG or PG	To be Offered in MS or WS

Signature of HoD