

# GUJARAT TECHNOLOGICAL UNIVERSITY

## CIVIL (WATER RESOURCES ENGINEERING) (33)

### ADVANCED FLUID MECHANICS

**SUBJECT CODE:** 2713303

**SEMESTER:** I

**Type of course:** Applied Fluid mechanics

**Prerequisite:** Fundamental knowledge of properties of fluid, Fundamental knowledge of engineering mathematics, Knowledge of equations of motion, energy and momentum and free surface flow.

**Rationale:** Students will be able to understand Navier-Stokes equation solutions, design of open channel, finite difference method, finite element method and design of mobile boundary channel

#### Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	PA (V)		PA (I)			
		ESE			OEP	PA	RP			
3	2#	2	5	70	30	20	10	10	10	150

#### Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Flow in pipes: Equation of fluid motion, Momentum and Energy equations, Navier-Stokes equation exact and approximate solutions, laminar and turbulent flow in pipes, Boundary layer theory, boundary stress, skin drag, water hammer analysis	18	40
2	Flow in channels: Steady-non uniform flow, water surface profiles and its computation, Design of channel transitions, unsteady flow - propagation of positive and negative waves, surges in channel resulting from gate operation, application of Method of Characteristics, Finite Difference and Finite element methods to transient flow in open channels, flow in mobile boundary channel, spatially varied flow, Dispersion in open channel.	24	60

#### Reference Books:

- 1 Engineering Hydraulics - Hunter Rouse.
- 2 Engineering Fluid Mechanics - Narasimhan.
- 3 Open channel Hydraulics - V.T.Chow
- 4 Open channel flow - Henderson
- 5 Open channel hydraulics - Richard H. French
- 6 Flow through open channel – K. Subramanya
- 7 Flow through open channel – K. G. Ranga Raju
- 8 Open Channel Flow – M. Hanif Chaudhry
- 9 Fluid Mechanics – Granger
- 10 Fluid mechanics – Streeter and Wiley

**Course Outcome:**

After learning the course the students should be able to: understand advance topics of fluid mechanics and open channel flow and application of these topics in real life problems

**List of Experiments:**

1. Water surface profile in open channel flow
2. Pipe friction
3. Laminar and turbulent flow in pipes
4. Propagation of positive and negative waves
5. Surges in channel resulting from gate operation
6. Drag and lift on a flat plate and cylinder

**Open Ended Projects:**

1. Velocity distribution in open channel
2. Measurement of Hydraulic jump
3. Application of fundamentals of Navier-Stokes equation

**Major Equipments:**

1. Tilting flume
2. Wind tunnel

**List of Open Source Software/learning website**

<http://www.springer.com/materials/mechanics/journal/162>