GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering (Part Time)
Subject Code: 2940606
Semester – 4
Subject Name: PIPELINE ENGINEERING

Type of course: Program Elective

Prerequisite: Knowledge of Fluid Mechanics and Basic Hydraulics

Rationale:
1. To develop a basic understanding about the pipe line flow, its analysis and applications.
2. To enable the students to apply the basic principles of Pipe line flows to solve real life problems.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**MODULE I** **Flow through pipes:** Introduction-Continuity equation-Energy equation-Momentum equation-Major and minor energy losses, hydraulic gradient energy line-pipes in series and parallel-pipe networks-hydraulic transmission of power. Navier-Stokes equation of motion- Initial conditions and boundary conditions.	**08**
2	**MODULE II** **Introduction to pipe flow and Viscous flow through pipes** Reynolds number and Reynolds experiment, classification of fluid flow in pipes, flow of viscous fluid through circular pipe- Hagen Poiseuille formula, Flow of viscous fluid between two parallel fixed plates, methods of measurement of viscosity. Couette flows, Poiseuille flows, Fully developed flows in non- circular cross-sections, Unsteady flows, Creeping flows.	**10**
3	**MODULE III** **Turbulent Flow:** Expression for coefficient of friction -Darcy Weisbach Equation, Moody diagram resistance of smooth and rough pipes shear stress and velocity distribution in turbulent flow through pipes. Turbulent pipe flow, Prandtl mixing hypothesis, Turbulence modeling, Free turbulent flows, water hammer.	**08**
4	**MODULE IV** **Boundary Layer Theory:**	**08**

	Boundary layer concept-laminar and turbulent boundary layer growth over a flat plate, Von-Karman momentum integral equation- Separation of boundary layer and wake formation. Design of Draft tube, Penstocks and other pipe structures used in turbines/ Power plants.	
5	**MODULE V** **Compressible Flows:** Basic equations, Mach number, Mach cone, Area-velocity relationship, Propagation of sound wave, Stagnation properties. Basic equations, Mach number, Mach cone, Area-velocity relationship, Propagation of sound wave, Stagnation properties.	**08**

Suggested Specification table with Marks (Theory): (For PDDC only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20%	**20%**	**15%**	**20%**	**15%**	**10%**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Frank M. White, Fluid Mechanics (Sixth Edition), Tata McGraw-Hill, New Delhi (2008).
2. J. O. Wilkes, Fluid Mechanics for Chemical Engineers, Prentice Hall (1999).
3. K.L. Kumar, Engineering Fluid Mechanics, S. Chand & Company Ltd.
4. P.M. Modi and S.M. Seth, Hydraulics and Fluid Mechanics, Standard Book House
5. A.K. Jain, Fluid Mechanics, Khanna Publishers,
6. K. Subramania, Theory and Applications of Fluid Mechanics, Tata McGraw Hill.

Course Outcomes: At the end of the course, Student will be able to

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Classify the fluids in pipe flow with its advanced implications	20
CO-2	Develop understanding about losses in pipe flow and behavior of flow through pipes under various conditions	20
CO-3	Understand Boundary layer theory with its applications	20
CO-4	Apply the concepts of compressible fluid flows to solve field problems	20

CO-5	Pursue the knowledge of Pipe line flow in the advancement of Fluid Mechanics field.	20

List of Experiments/Tutorials:

Students will have to perform following experiments in laboratory and prepare the laboratory manual. The students will have to solve five problems covering all modules.

1. Reynold's experiment
2. Viscous flow through parallel plates
3. Pipe friction
4. Turbulent flow problems
5. Boundary layer flow problems
6. Compressible flow problems

List of Open Source Software/learning website:

1. http://www.nptel.iitm.ac.in/courses/