GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMICAL TECHNOLOGY (36)
BASICS OF FLUID FLOW
SUBJECT CODE: 2153612
B.E. 5th SEMESTER

Type of course: Chemical Technology

Prerequisite: A good understanding regarding basic states of matter along with behavior of fluid under static and dynamic conditions. Mathematical background is also essential in this respect.

Rationale: This subject is intended to make students aware about types and behavior of fluid with the basic fundamentals underlying the operation of fluid for chemical technologies. Apparently the subject aims at measurement techniques involved for the pressure concepts, fluid flow and equipments used for the transportation of fluids.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No	Topics	Teaching Hrs.	Module Weightage
1.	Introduction to fluid and its application: Unit Operations and Processes, fluid properties and its classification, Pressure – Hydrostatic Equation, Pressure scales and Measurement, Manometers – different types of manometers.	5	12
2.	Fluid Flow phenomena and its basic equations: Fluid flow, Boundary layer, Transition length, Wake formation, Continuity equation, Bernoulli's equation, Correction factors in Bernoulli's Equation, Pump Work.	7	17
3.	Flow of incompressible fluids in conduits and thin layers: Shear stress distribution, friction factor, Hagen Poiseulli's Equation, Flow through non-circular cross sections, Equivalent diameter, Hydraulic radius, friction loss from sudden expansion or contraction of cross section and fittings and valves, Form friction and skin friction.	6	14
4.	Flow past Immersed bodies: Drag, Drag Coefficients, Stream lining, Stagnation pressure. Flow of fluid through a bed – Fluidization, Types of fluidization and applications. Motion of particles through fluids	5	12
5.	Transportation and metering of fluids: Pipes, tubes, joints and fittings selection of pipe size, Valves like Gate, Globe, Plug cocks, Ball, Check valves Introduction to fluid flow measuring instruments like venturimeter, orifice meter, area meters like Rota meter, target meters, coriolis meters, magnetic meters etc.	7	17

6.	Fluid Flow through Machinery: Pumps, its characteristics like developed head, power requirement, suction lift and cavitations; positive displacement pumps like reciprocating, rotary pumps, centrifugal pump, introduction to centrifugal blowers, compressor, vacuum pumps, jet ejectors	6	14
7.	Agitation and Mixing: Impellers and its use in various chemical technology, Types, Flow pattern in agitated vessels, Swirling and its prevention, Power consumption in agitated vessels, Power correlations. Blending and Mixing-In process vessels	6	14

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20%	**23%**	**23%**	**18.8%**	**15.2%**	**-**

Reference Books:

1. W.L.Mc.Cabe, J.C.Smith and P.Harriot, "Unit operations of chemical engineers", McGraw Hill International edition VII.
2. Chemical Engineering Vol.I and II by Coulson and Richardson. Pergamon Press Publications.
3. Noel de.Nevers, "Fluid mechanics for Chemical Engineers", McGraw Hill International edition.
4. Fluid Mechanics – Basic Concepts and Principles. Shiv Kumar, Ane Books Private Limited

Course Outcome:

After learning the course the students should be able to

1. Properly understand classify and exploit fluids based on their physical properties
2. Compute the flow regime in different flow situations with forces acting on fluid element

List of Experiments:

1. Verification of Bernoulli's Equation.
2. Frictional pressure drop in a circular pipe
3 Classification of flow based on Reynolds's experiment.
4. Equivalent length of pipe fittings.
5. Determination of Hydraulic coefficients of Orifice.
6. Calibration of Rotameter
7. Determination of discharge coefficient of V – notch.
8. Estimation of viscosity of fluid by Stoke's law
9. Characteristics of centrifugal pump.
10. Frictional pressures drop in annular pipe.

Design based Problems (DP)/Open Ended Problem:

To study utility of Major Equipments like: Venturi meter, Orifice meter, Rotameter, Various pumps, Notches, Pipes and Valves etc

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.