Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Diploma Engineering College
Semester 4 (Diploma)

Subject: Fluid Flow Operations – DETCH14208

Type of course: Major

Prerequisite: Basic knowledge of Physical changes and fluid properties.

Rationale: Fluid flow operations are fundamental to a wide range of industries, from chemical engineering and petroleum refining to environmental engineering and biomedical applications. Understanding and controlling fluid flow is crucial for efficient, safe, and sustainable processes.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	2	5	60	30	10	20	30	150

Legends: CI - Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE - Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Sr. No.	Course content	Hrs	Weightage
1.	**Introduction:** Nature of fluids, Hydrostatic Equilibrium, Hydrostatic equilibrium in centrifugal field, Applications of Fluid Statics: Manometers, Continuous gravity decanter, Centrifugal decant, Flow through continuous decanters.	10	20%
2.	**Fluid Flow Phenomena :** The Velocity field, one-dimensional flow, Laminar Flow, Shear Rate and Shear Stress, Laminar flow. Rheological properties of Fluids: Newtonian and non-Newtonian fluids, Time-dependent flow, visco-elastic fluids, viscocity and momentum flux, viscosities of gases and liquids, Turbulence: Reynolds number and transition	20	30%

	from laminar to turbulent flow, Nature of turbulence, statistical nature of turbulence.		
3.	**Basic Equation of Fluid Flow:** Mass Balance in Flowing Fluid, Continuity, shell balance for mass flow, mass velocity, Differential Momentum Balance, Equations of Motion, Navier-stokes equations, Euler's equation, Couette flow, Macroscopic Momentum Balances: Momentum of total stream, momentum correction factor, layer flow with free surface, Angular momentum equation, Mechanical Energy Equation: Energy equation for potential flow; Bernoulli equation without friction, kinetic energy of stream, kinetic energy correction factor.	15	30%
4.	**Incompressible Flow in Pipes and Channels:** Shear Stress and Skin Friction In Pipes: shear-stress distribution, relation between skin friction and wall shear, relation between skin friction parameter, Laminar Flow in pipes and channels: Average velocity, Hagen-poiseuille equation, laminar flow of non-Newtonian liquids, laminar flow in an annulus, Turbulent Flow in pipes and channels: velocity distribution for turbulent flow, universal velocity distribution equation, Relation and limitation of friction factor.	15	20%

Continuous Assessment:

Sr. No.	Active Learning Activities	Marks
1.	**List different equipments used in fluid statics:** Make a list of different equipments used to measure various parameters of fluid in static position and upload on GMIU Web portal.	10
2.	**List different equipments used in fluid in motion:** Make a list of different equipments used to measure various parameters of fluid in motion and upload on GMIU Web portal.	10
3.	**Problem solving**: (a) Numericals based on friction velocity (b) Numericals based on pipes Students have to solve them and upload on GMIU web portal.	10
Total		30

Suggested Specification table with Marks (Theory): 60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	20%	20%	25%	15%	20%	00

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.

Course Outcome:

After learning the course the students should be able to:	
CO1	Create a vision of understanding the momentum transfer process.
CO2	Analyze different fluid flow concepts.
CO3	Perform calculations of fluid flow in process industry.
CO4	Utilize the technological methods in problem solving in transportation of fluids in process plant.

List of Practical:

Sr. No.	Practical	Unit	Hours
1	To study and verify Bernoulli's Theorem	2	2
2	To calibrate Venturimeter and obtain it's coefficient of discharge.	1	2
3	To calibrate an Orifice meter and obtain it's coefficient of discharge	1	2
4	To study a Rotameter and obtain it's coefficient of discharge	1	2
5	To Study Notched Weirs Apparatus and obtain its discharge coefficient.	2	4
6	Study of Pressure measurement devices.	2	4
7	Friction Vs. Re losses in Pipe Friction using water.	3	4
8	To study Reynolds's Experiment Apparatus.	3	2
9	Centrifugal Pump testing	4	4
10	To measure pressure of different systems using manometers	1	4
Total			30

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1] Unit Operations of Chemical Engineering, McCabe W L, Smith J C, Harriott P, Mc Graw Hill Publication, 7th edition 2005.

[2] Chemical Engineering Vol. I – Fluid flow, Heat Transfer and Mass Transfer; Coulson & Richardson's, Butterworth – Heinemann Publication, 6th Edition.

[3] Fluid Dynamics and Heat Transfer, James G. Knudson and Donald L. Katz, McGraw Hill Publication.