Course Syllabus
Gyanmanjari Institute of Technology
Semester-3 (Degree)

Subject: Fluid Flow Operations -BETCH13302

Type of course: Major

Prerequisite: Basic knowledge of Chemistry

Rationale: To understand the fundamentals of fluid flow phenomena. Deriving the mass and momentum balance equations from first principles. To learn about the transportation of fluids and flow measuring devices.

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	
04	00	02	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** Introduction, Ideal and real fluids, Extensive and Intensive Properties, Specific Weight, Mass density and Specific gravity, Viscosity, Surface Tension and Capillarity, Evaporability and Vapour pressure, Newtonian & Non Newtonian fluids.	15	25%
2	**Fluid statics** Pressure, Hydrostatics law, Pascal's Law, Different types of manometer, Continuous gravity Decanter, Centrifugal decanter and other pressure-	15	25%

	measuring equipment's, Determination of meta centric height. Fluid kinematics and Dynamics Reynolds transport theorem, Classification of fluid flows, streamline, streak line, and Path lines, Flow rate & continuity equation, Bernoulli's Theorem, Kinetic energy correction factor and momentum correction factor in Bernoulli's equation.		
3	**Laminar viscous flow and Flow measurement devices:** Flow regimes and Reynolds numbers, Laminar flow in circular pipes (Hagen Poiseuille Law), Orifice meter; Venturimeter; Weirs, concept of area meters: rotameter; Local velocity measurement: Pitot tube. Hot wire anemometer, mass flowmeter.	15	25%
4.	**Hydraulic pumps** Pump Classification & Applications, Centrifugal pumps vs Reciprocating pumps, pump losses and Efficiencies, Multistage pumps, Work and power Input, Cavitation and maximum Suction lift, specific and minimum speed. **Flow around Immersed Bodies** Introducing the concepts of transition and turbulence. Drag force, lift and drag coefficients, drag on Flat Plate, Circular Cylinder and Sphere.	15	25%
	Total	60	100%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1.	**Industry Case Studies:** Present case studies of real-world fluid flow operations in industries such as petrochemicals, pharmaceuticals, or food processing. Discuss the design, operation, and optimization of fluid flow systems, highlighting practical challenges and solutions encountered in industry.	10
2.	**Problem-Solving:** Students need to work on solving fluid flow problems collaboratively. Provide them with challenging problems related to pipe networks, pump selection, or flow control, and encourage them to apply theoretical principles to develop solutions.	10
3.	**Quizzing** Interesting quiz will be assigned to students and they have to submit it in 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	35%	35%	20%	10%	00%	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	Able to measure pressure drop. flow rates etc. for incompressible and compressible fluids.
CO2	Ability to select pumps. valves. and would be able to calculate power requirement for pumping as well as agitation operations.
CO3	Ability to analyze the fluid flow problems with the application to the momentum balance
CO4	Applying the principles of fluid mechanics to chemical engineering problems

List of Practical:

Sr. No	Descriptions	Unit No.	Hrs
1.	To study and verify Bernoulli's Theorem	All	30
2	To calibrate Venturi meter and obtain it's coefficient of discharge.		
3	To calibrate an Orifice meter and obtain it's coefficient of discharge.		
4	To study a Rota meter and obtain it's coefficient of discharge.		
5	To Study Notched Weirs Apparatus and obtain its discharge coefficient.		
6	Study of Pressure measurement devices.		
7	Friction Vs. Re losses in Pipe Friction using water.		
8	Centrifugal Pump testing.		
	Total		30

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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 by Julian c smith, peter harriott and warren McCabe.
[2] Frank M. White, "Fluid mechanics", 7th Edition, McGraw Hill (2010).
[3] Vijay Gupta, Santhosh Kumar Gupta, Fluid Mechanics and its application, New Age International Publication, New Delhi.
[4] Radhakrishnan, E., Fluid Mechanics, Prentice Hall of India, New Delhi
[5] Vyas R.P., Fluid Mechanics, Dennet and Co. Publications, Nagpur

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