NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B. Tech. (Chemical Engineering)
Course Code:	2CH203CC23
Course Title:	Fluid Flow Operations
Course Type:	Core
Year of introduction:	2023-2024

L	**T**	**Practical component**				**C**
		LPW	**PW**	**W**	**S**	
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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. study the concepts of fluid flow operations (BL2)
2. apply fundamental flow equations to practical systems (BL3)
3. estimate the performance of various fluid transport, metering and agitation devices (BL5)
4. assess the behaviour of fluids flowing in closed conduits (BL5)

Syllabus: **Total Teaching hours: 30**

Unit	**Syllabus**	**Teaching hours**
Unit I	**Fluid Statics:** Concept of fluid and flow, Ideal and real fluids, Properties of fluids, Hydrostatic equilibrium, Pressure concept, Rheology of fluids, Viscosity, Reynolds no., boundary layer theory.	04
Unit II	**Basic Equations of Fluid Flow:** Mass balance (Continuity Equation), Mechanical Energy Equation (Bernoulli's equation with modifications), Correction factors.	07
Unit III	**Pipeline flow:** Shear stress and velocity in pipes, Hagen-Poiseuille law, Effect of Roughness, Friction Factor Chart, Minor losses, Darcy's Equation.	07
Unit IV	**Transportation, Metering and Agitation of Fluids:** Pipe and Joints, Pumps– Positive Displacement Pumps, Centrifugal Pumps, Characteristic curves, Cavitation and NPSH, Compressors, Valves, Notches, Flowmeters, Pitot tube, Standard Agitated Vessel, Power Consumption.	12

Self-Study:
Self-study contents will be declared at the commencement of the semester. Around 10 % of the questions will be asked from the self-study contents.

Laboratory Works:
Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

Suggested Readings/ References:

1. McCabe, W. L., Smith, J. C., & Harriott, P., Unit operations of chemical engineering McGraw-Hill.
2. Gupta, V., Gupta, S. K., Fundamentals of Fluid Mechanics, New Age International.
3. White, M., Fluid Mechanics, Tata Mc-Graw Hill Publication.
4. Wilkes, J. O., Fluid Mechanics for Chemical Engineers, Prentice Hall.
5. Fox, R.W., Pritchard, P.J., McDonald, A.T., Introduction to Fluid Mechanics, Wiley-India.
6. Mathieu, M., Fluid Mechanics for Chemical Engineers, Wiley.

Suggested List of Practical (not restricted to the following) only for information

Sr.	Practical	No. of Hours
1	To determine the viscosity of oil by Redwood viscometer.	02
2	To prove that the intensity of pressure at any depth of static liquid is proportional to the depth of immersion.	02
3	To study the flow pattern of a fluid flowing in a pipe.	02
4	To verify the principle of conservation of energy by finding out the pressure head and velocity head and applying the Bernoulli's equation to a venturi meter.	02
5	To calibrate the given Orifice meter.	02
6	To calibrate the given Venturi meter.	02
7	To calibrate the given Rotameter.	02
8	To measure velocity of flow using Pitot tube.	02
9	To determine head losses due to sudden contraction, sudden enlargement and fittings.	02
10	To determine friction factor of different closed conduits.	02
11	To calibrate rectangular notch and triangular notch.	02
12	Virtual lab experiment	02