25UCET301	**FLUID MECHANICS**	Category	L	T	P	R	**Credit**	**Year of Introduction**
		PCC	3	1	0	0	4	**2025**

Preamble: This course introduces learners to the essential principles governing fluid behaviour in static and dynamic conditions. The subject develops conceptual clarity on fluid properties, pressure measurement, kinematics, and energy relationships, while extending applications to pipe flow and open channel flow systems.

Prerequisite: Nil

Course Outcomes: After the completion of the course, the student will be able to:

CO	Course Outcomes	Knowledge Level
CO1	Describe the physical properties of fluids and pressure characteristics using principles of fluid statics and pressure measurement devices.	K2 Understand
CO2	Determine hydrostatic forces on submerged surfaces and apply buoyancy principles to assess the stability of floating and submerged bodies.	K3 Apply
CO3	Apply continuity, energy, and momentum principles to determine fluid flow behaviour and solve related engineering problems.	K3 Apply
CO4	Determine flow characteristics in pipes, orifices, notches, and open channel systems, considering energy losses and discharge relationships.	K3 Apply

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	**3**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**-**
CO2	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**-**
CO3	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**1**
CO4	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**
Avg	**3**	**2.5**	**2**	**1.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1.5**	**1**

Mapping of course outcomes with Knowledge and Attitude Profile (WK)

	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	*	*	*	*	*			*	
CO2	*	*	*	*	*			*	
CO3	*	*	*	*	*			*	
CO4	*	*	*	*	*			*	

WKs Mapped with the course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
*	*	*	*	*			*	

Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	**40**	**60**	**2.5 hrs**

Continuous Internal Evaluation Pattern:

Attendance : 5 marks
Continuous Assessment Test : 20 marks
Continuous Assessment Assignment /Field study/Industrial Visit: 15 marks

SYLLABUS

Module 1 (14 hrs)

Introduction to fluids and their physical properties - Newton's law of viscosity and classification of fluids - Introduction to Non-Newtonian fluids and examples from engineering and industrial applications - Fluid pressure concepts, Pascal's law and Hydrostatic law - Measurement of pressure using manometers: piezometer, U tube manometer, differential manometers and inverted differential manometers - Brief overview of mechanical pressure gauges - Numerical problems on pressure measurement and hydrostatics.

Module 2 (14 hrs)

Hydrostatic forces on submerged surfaces: vertical, horizontal, inclined, and curved surfaces - Determination of total pressure and centre of pressure with numerical applications - Buoyancy and floatation: centre of buoyancy, meta centre, and meta centric height - Stability analysis of floating and submerged bodies - Analytical determination of meta centric height and conceptual description of experimental methods - Discussion on engineering significance of stability, including applications in floating structures, storage vessels, marine systems, and submerged bodies - Numerical problems on buoyancy and stability.

Module 3 (14 hrs)

Description of fluid motion: Lagrangian and Eulerian approaches - Classification of fluid flow - Continuity equation in one, two, and three dimensions -Velocity and acceleration in fluid flow - Streamlines, pathlines, streaklines, velocity potential, stream function, and flow nets - Concept of

dimensionless numbers and Reynolds number in fluid flow analysis and similarity - Fluid dynamics: Euler's equation of motion - Bernoulli's equation with assumptions and limitations - Applications of Bernoulli's equation: Venturimeter, Orifice meter and Pitot tube - Momentum equation and forces on pipe bends. Numerical problems.

Module 4 (14 hrs)

Flow through orifices, hydraulic coefficients and discharge relationships - Discharge through large orifices and time of emptying (numerical problems) - Flow measurement using notches and weirs: rectangular, triangular, and trapezoidal notches/weirs, including velocity of approach and end contraction effects - Numerical problems - Pipe flow: major and minor losses, Darcy Weisbach equation, hydraulic gradient line, total energy line, pipes in series and parallel, equivalent pipes - Open channel flow: comparison with pipe flow and classification. (Concept only).

Field study/Industrial Visit :

Visit to a pumping station / water treatment plant / irrigation structure to observe flow measurement devices, pipe systems, and energy loss phenomena. Submission of a brief technical observation report is mandatory as a part of assessment.

Text Books:

1. P. N. Modi & S. M. Seth(2019). *Hydraulics and Fluid Mechanics including Hydraulic Machines*. 22nd Edition. Rajsons Publications.Standard Book House.
2. R. K. Bansal (2023). *Fluid Mechanics and Hydraulic Machines*.11th Edition. Laxmi, Publications.
3. K. Subramanya(2019).*Flow in Open Channels*.5th Edition. Mc Graw Hill Publishers.

Reference Books:

1. Arora.K.R(2005). Fluid Mechanics, Hydraulics and Hydraulic Machines.Standard Publishers.
2. Victor Streeter, E. Benjamin Wylie, K.W. Bedford (2017). Fluid Mechanics. Mc Graw Hill Publishers.
3. Bruce R. Munson, Donald F. Young, Theodore H. Okiishi(2005). Fundamentals of Fluid Mechanics. 9th Edition. John Wiley & Sons Inc.

END SEMESTER EXAMINATION – MODEL QUESTION PAPER

Course Code	**25UCET301**
Course Name	**FLUID MECHANICS**
Max. Marks: 60	**Duration: 2.5 Hours**

Part A *(Answer all questions. Each question carries 3 marks)*				
Qn No.	**Question**	**Marks**	**CO**	**BL**
1	Classify fluids based on their rheological behaviour with suitable examples.	3	1	L2
2	Explain Pascal's law and its engineering applications.	3	1	L2
3	Explain the concepts of centre of buoyancy and metacentre.	3	2	L2
4	Distinguish stable, unstable and neutral equilibrium of floating bodies.	3	2	L2
5	Differentiate Eulerian and Lagrangian descriptions of fluid motion.	3	3	L2
6	Explain the significance of Reynolds number in fluid flow analysis.	3	3	L2
7	Explain the hydraulic coefficients of an orifice.	3	4	L2
8	Distinguish hydraulic gradient line and total energy line.	3	4	L2
Part B (*Answer any one full question from each Module. Each carry 9 marks*)				
Module I				
Qn No.	**Question**	**Marks**	**CO**	**BL**
9.a	Explain the working principle of a differential manometer.	3	1	L2
9.b	Compare Newtonian and Non-Newtonian fluids with suitable engineering applications.	6	1	L2
OR				
10.a	Explain Newton’s law of viscosity.	3	1	L2
10.b	Describe various pressure measuring devices used in fluid mechanics and their applications.	6	1	L2
Module II				
Qn No.	**Question**	**Marks**	**CO**	**BL**
11.a	Explain the procedure to determine the metacentric height of a floating body.	3	2	L2
11.b	A rectangular plate 2 m wide and 3 m high is immersed vertically in water with its top edge 1 m below the free surface. Determine: (i) Total hydrostatic force (ii) Position of centre of pressure	6	2	L3
OR				
12.a	Explain the significance of centre of pressure in engineering	3	2	L2

	applications.			
12.b	A wooden block measuring 2 m × 1 m × 0.8 m and having specific gravity 0.7 floats in water. Determine the metacentric height and comment on its stability.	6	2	L3
Module III				
Qn No.	**Question**	**Marks**	**CO**	**BL**
13. a	Explain the impulse-momentum principle.	3	3	L2
13. b	An orifice meter consisting of an 80 mm diameter orifice fitted in a 200 mm diameter pipe has Cd = 0.65. The pipe carries oil of specific gravity 0.8. If the differential manometer reading is 700 mm of mercury, determine the discharge through the pipe.	6	3	L3
OR				
14. a	Explain the assumptions made in deriving Bernoulli's equation.	3	3	L2
14. b	Water flows through a horizontal pipe bend reducing from 300 mm diameter to 150 mm diameter. The discharge is 0.12 m^3/s and inlet pressure is 250 kPa. Determine the force exerted on the bend using the momentum equation.	6	3	L3
Module IV				
Qn No.	**Question**	**Marks**	**CO**	**BL**
15. a	Explain major and minor losses in pipe flow.	3	4	L2
15. b	A circular tank of diameter 2 m contains water up to a height of 3 m. If an orifice of diameter 150 mm is provided at the bottom, determine the time required to empty the tank. Take Cd = 0.62.	6	4	L3
OR				
16. a	Distinguish rapidly varied flow and gradually varied flow.	3	4	L2
16. b	A 40 m long rectangular weir is divided into 12 equal bays by vertical posts each 0.6 m wide. Taking Cd = 0.623, determine the discharge over the weir if the head over the crest is 1.2 m and the velocity of approach is 2 m/s.	6	4	L3

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