SEMESTER S4

FLUID MECHANICS

Course Code	PEPOT416	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Basic knowledge in Fluid Mechanics	Course Type	Theory

Course Objectives:

1. To study the mechanics of fluid motion.
2. To establish fundamental knowledge of basic fluid mechanics and address specific topics relevant to simple applications involving fluids.
3. To familiarize students with the relevance of fluid dynamics to many engineering systems.

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SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Fluids: -** properties and nature of fluids, ideal fluids, real fluids, physical properties of fluids, density, viscosity, effect of viscosity on temperature and pressure, specific volume, stress and strain, bulk modulus, specific weight, relative density, surface tension, compressibility, capillarity. Rheology of fluids **Rheological classification of fluids: -** Newtonian and non-Newtonian fluids, Newton's law of viscosity, classifications of non-Newtonian fluids**.** **Fluid Pressure Measurements:** Pascal's law, vacuum and gauge pressures, hydrostatic law, measurement of fluid pressure using manometers and its different classifications, problems based on manometer.	9

2	**Introduction to fluid flow: -** Fluid flow classifications, Flow field, Eulerain and Lagrangian approach, velocity potential, stream function, circulation and vorticity. Streamline, Path line, Streak line, Stream tube classification of flow, Reynolds experiment, Reynolds number, Mach number, Turbulence, Reynolds stress. Velocity and acceleration in fluid	**9**
3	**Fluid dynamics: Continuity equation: -** Euler's, and Bernoulli's equations (Derivation not required) –Applications - Orificemeter, Venturimeter and associated simple numerical problems, Hydraulic coefficients **Velocity measurements: - Pitot** tube and Pitot-static tube. Introduction to Rectangular and Triangular Notches	**9**
4	**Shear stress and velocity distribution in a pipe: -** law of fluid friction, head loss due to friction, Hagen Poiseuille equation. Turbulent flow: Darcy-Weisbach equation, Chezy's equation Moody's chart, Major and minor energy losses. **Hydraulic gradient and total energy line, flow through long pipes: -** pipes in series, pipes in parallel, equivalent pipe. Transmission of power through pipes, efficiency of transmission, Water hammer, Cavitation.	**9**

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Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination -1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

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	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Understanding of Fluid Behavior, Properties, Application and Measurement in Engineering Systems	**K3**
CO2	Application and Analysis of Fluid Flow Phenomena and Fluid Flow Dynamics.	**K4**
CO3	Application and Measurement Techniques in Fluid Flow	**K3**
CO4	Interpret Euler and Navier-Stokes equations and Solve problems using Bernoulli's equation	**K3**
CO5	Evaluate energy losses in pipes and sketch energy gradient lines	**K5**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1									
CO2	3	2	1									
CO3	3	3	2									
CO4	3	3	2									
CO5	3	3	2									

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	A Textbook of Fluid Mechanics and Hydraulic Machines	Bansal R. K.,	Laxmi Publications,	2005
2	Engineering Fluid Mechanics	Balachandran.P	PHI	2012
3	Fluid Mechanics	Dr. D S Kumar	S K Kataria and Sons;	2012

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Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fluid Mechanics	Cengel	McGraw Hill Education India	2014
2	Hydraulics & Fluid Mechanics	Modi P. N. and S. M. Seth,	S.B.H Publishers, New Delhi,	2002
3	Fluid Mechanics	White, F. M.	McGraw Hill Education India Private Limited	2017
4	Fluid Mechanics: An Introduction	Radhakrishnan E.	Prentice Hall India	3rd Edition 2012

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	Fluid Mechanics, Prof. Suman Chakraborty, IIT Kharagpur https://nptel.ac.in/courses/112105171
2	Fluid Mechanics, Prof. Nishith Verma, IIT Kanpur https://nptel.ac.in/courses/103104043
3	Fluid Mechanics, Dr. T.I. Eldho, IIT Bombay https://nptel.ac.in/courses/105101082
4	Fluid Mechanics, Dr. N. Sahoo, Dr.Subhashisa Dutta, IIT Guwahati https://nptel.ac.in/courses/105103095

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