

HYDRAULICS AND HYRAULIC MACHINERY
SYLLABUS

Course Code	23CE3403	Year	II	Semester	II
Course Category	Professional Core	Branch	CIVIL	CourseType	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Fluid Mechanics
Continuous Internal Evaluation	30	Semester End Evaluation:	70	Total Marks:	100

Pre-requisite: Fluid Mechanics

Course Objectives:

1. To Introduce concepts of laminar and turbulent flows
2. To teach principles of uniform flows through open channel.
3. To teach principles of non-uniform flows through open channel.
4. To impart knowledge on design of turbines.
5. To impart knowledge on design of pumps

Course Outcomes:

On Completion of the course, the students will be able to:

COs	STATEMENTS	Blooms level
CO1	Understand the characteristics of laminar and turbulent flows	L2
CO2	Apply the knowledge of fluid mechanics to address the uniform flow problems in open channels.	L3
CO3	Solve non-uniform flow problems and hydraulic jump phenomenon in open channel flows.	L3
CO4	Evaluate the performance of impact of jets on plates and design Pelton wheel, Francis turbine	L5
CO5	Apply the principles to analyze losses and efficiencies of centrifugal pumps	L4

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	2	-	-	-	-	2	-	3	1
CO2	3	3	-	-	-	3	-	-	-	-	3	-	3	1
CO3	3	3	-	-	-	3	-	-	-	-	3	-	3	1
CO4	3	3	-	-	-	3	-	-	-	-	3	-	3	2
CO5	3	2	-	-	-	2	-	-	-	-	2	-	3	2

Unit No	Content	Mapped COs
I	Laminar & Turbulent flow in pipes: Laminar Flow- Laminar flow through: fixed parallel plates, circular pipes, Transition from laminar to turbulent flow. Resistance to flow of fluid in smooth and rough pipes-Moody's diagram – Introduction to boundary layer theory only definitions and concept.	CO1
II	Uniform flow in Open Channels: Open Channel Flow - Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channel flow, Velocity Distribution of channel section. Hydraulically efficient channel sections: Rectangular, trapezoidal and triangular channels, Energy and Momentum correction factors	CO2
III	Non-Uniform flow in Open Channels: Specific energy, critical flow, specific energy curve, Alternate depths and Critical depth. Non-Uniform flow – Gradually Varied Flow- Dynamic Equation of Gradually Varied Flow. Hydraulic Jump and classification - Elements and characteristics- Energy dissipation -problems	CO3
IV	Impact of Jets: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes - Velocity triangles at inlet and outlet - Work done and efficiency of Hydraulic Turbines: Classification of turbines; pelton wheel and its design. Francis turbine and its design - efficiency - Draft tube: theory, unit quantities, specific speed, Cavitation: causes and effects.	CO4
V	pumps: Working principles of a centrifugal pump, work done by impeller; heads and efficiencies; minimum starting speed; Priming; specific speed; net positive suction head (NPSH) definition; Cavitation: causes and effects ; Multistage centrifugal pumps; series and parallel	CO5

TEXT BOOKS: -

1. P. M. Modi and S. M. Seth, Hydraulics and Fluid Mechanics, Standard Book House 22nd, 2019.
2. K. Subrahmanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill, 2nd edition 2018

Reference Books:

1. R. K. Bansal, A text of Fluid mechanics and hydraulic machines, Laxmi Publications (P) Ltd., New Delhi 11th edition, 2024.
2. Fluid Mechanics by Frank M. White, Henry Xue, Tata McGraw Hill, 9th edition , 2022.
3. C. S. P. Ojha, R. Berndtsson and P. N. Chadramouli, Fluid Mechanics and Machinery, Oxford University Press, 2010.
4. Introduction to Fluid Mechanics & Fluid Machines by S K Som, Gautam Biswas, S Chakraborty 3rd edition 2011

Online Learning Resources:

- <https://nptel.ac.in/courses/105105203>
<https://archive.nptel.ac.in/courses/112/106/112106300/>
<https://archive.nptel.ac.in/courses/112/103/112103249/>