II Year-II Semester
(20CE4007) Hydraulics & Hydraulic Machines

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

Pre- Requisites: Fundamentals of Engineering mechanics and Fluid Mechanics

Course Objectives:

- To study about uniform and non uniform flows in open channel and also to learn about the characteristics of hydraulic jump
- To introduce dimensional analysis for fluid flow problems
- To understand the working principles of various types of hydraulic machines and Pumps.

UNIT-I: Uniform Flow in Open Channels:
Types of channels –Types of flows - Velocity distribution– Chezy's, and Manning's formulae for uniform flow – Most Economical sections, Critical flow: Specific energy-critical depth – computation of critical depth

UNIT-II: Non-Uniform Flow in Open Channels:
Steady Gradually Varied flow-Dynamic equation, Mild, Critical, Steep, horizontal and adverse slopes-surface profiles direct step method- Rapidly varied flow, hydraulic jump, energy dissipation.

UNIT-III: Hydraulic Similitude:
Dimensional analysis-Rayleigh's method and Buckingham's pi theorem-study of Hydraulic models – Geometric, kinematic and dynamic similarities-dimensionless numbers – model and prototype relations.

UNIT-IV: Basics of Turbo Machinery:
Hydrodynamic force of jets on stationary and moving flat , inclined and curved vanes, jet striking centrally and at tip, velocity triangle sat inlet and outlet, expressions for work done and efficiency.

UNIT-V: Hydraulic Turbines:
Layout of a typical Hydropower installation –Heads and efficiencies - classification of turbines. Pelton wheel - Francis turbine – Kaplanturbine - working, working proportions, velocity diagram, work done and efficiency. Draft tube –surge tanks-unit and specific quantities, performance characteristics-geometric similarity-Cavitation.

Centrifugal Pumps:
Pump installation details-classification-work done- Manometric head-minimum starting speed-losses and efficiencies-specific speed,- performance of pumps-characteristic curves-NPSH- Cavitation.
Reciprocating Pumps: Introduction, classification, components, working, discharge, indicator diagram, work done and slip.

Course Outcomes:

S.No	Course Outcomes	BTL
1	Solve uniform open channel flow problems.	L4
2	Solve non uniform open channel flow problems	L4
3	Apply the principals of dimensional analysis and similitude in hydraulic model testing.	L3
4	Understand the working principles of various types of hydraulic machines	L2
5	Recommend suitable pumps and turbines.	L5

Correlation of COs with POs& PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3
2	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3
3	3	3	3	3	2	3	3	3	3	3	3	3	3	2	2
4	3	3	3	2	2	3	3	3	3	3	3	3	3	2	2
5	3	3	3	2	2	3	3	3	3	3	3	3	3	2	2

Text Books:

1. Open Channel flow by K. Subramanya, Tata McGraw Hill Publishers
2. A text of Fluid mechanics and hydraulic machines by R. K. Bansal, Laxmi Publications New Delhi
3. Fluid Mechanics by Modi and Seth, Standard book house.

Reference Books:

1. Fluid Flow in Pipes and Channels by G.L. Asawa, CBS
2. Fluid Mechanics and Machinery by C.S.P. OJHA, R. BERNDTSSON and P.N. Chandramouli, Oxford Higher Education.
3. Fluid Mechanics and Machinery by Md. Kaleem Khan, Oxford Higher Education.