II Year II Semester	**L**	**T**	**P**	**C**
Code: 17CE402	**3**	**1**	**0**	**3**

HYDRAULICS AND HYDRAULIC MACHINES

Course Learning Objectives:

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

Course Outcomes:

Upon successful completion of this course the students will be able to

1. Understands about the uniform flow in open channels
2. Understands about the non uniform flow in open channels
3. Understands the dimensional analysis and different Hydraulic models
4. Understand the basics of Turbo machinery
5. Understand the working principles of various hydraulic turbines.
6. Understand the working principles of Centrifugal pumps

SYLLABUS

UNIT I

Uniform Flow In Open Channels:

Types of channels –Types of flows - Velocity distribution – Energy and momentum correction factors – Chezy's, and Manning's formulae for uniform flow – Most , 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-Angular momentum principle.

UNIT V

Hydraulic Turbines I:

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 – theory and efficiency. Governing of turbines-surge tanks-unitand specific quantities, selection of turbines, performance characteristics-geometric similarity-Cavitation.

UNIT VI

CentrifugalPumps:

Pump installation details-classification-workdone- Manometric head-minimum starting speed-losses and efficiencies-specific speed,multistage pumps-pumps in parallel and series - performance of pumps-characteristic curves-NPSH- Cavitation.

Reciprocating Pumps: Introduction, classification, components, working, discharge,indicator diagram, work done and slip.

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 NewDelhi
3. Fluid Mechanics byModi and Seth, Standard book house.

REFERENCES:

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.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
CO2	3	2	3	3	3	3	3	2	3	3	2	2	3	3	3
CO3	3	3	3	3	2	3	3	1	2	3	3	3	3	2	2
CO4	3	2	2	2	3	3	3	1	2	2	3	2	3	2	2
CO5	3	2	3	3	3	3	3	2	3	3	3	3	3	3	3
CO6	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3