COURSE CONTENT

HYDRAULICS AND HYDRAULIC MACHINERY								
IV Semester: CE								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
2540119	**Core**	3	0	0	3	40	60	100
Contact Classes:45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisites: NIL								

Course Overview :

Hydraulics and Hydraulic Machinery explores fluid behavior and its engineering applications. The course covers fluid statics, dynamics, flow through pipes and channels, and measurement techniques. It also studies hydraulic machines such as pumps, turbines, and waterwheels, focusing on their design, performance, and efficiency in water resource and industrial systems.

Course Objectives: The objective of the course is to

- Define the fundamental principles of water conveyance in open channels.
- Discuss and analyze the open channels in uniform and Non-uniform flow conditions.
- Study the characteristics of hydroelectric power plant and its components.
- Analyze and design of hydraulic machinery and its modeling.

Course Outcomes: At the end of the course the student will able to

- Apply their knowledge of fluid mechanics in addressing problems in open channels and hydraulic machinery.
- Understand and solve problems in uniform, gradually and rapidly varied flows in open channel in steady state conditions.
- Apply dimensional analysis and to differentiate the model, proto type and similitude conditions for practical problems.
- Get the knowledge on different hydraulic machinery devices and its principles that will be utilized in hydropower development and for other practical usages.

UNIT - I

Open Channel Flow–I: Introduction to Open channel flow - Comparison between open channel flow and pipe flow, Classification of open channel flows, Velocity distribution. Uniform flow–Characteristics of uniform flow, Chezy's, Manning's and Bazin formulae for uniform flow – Factors affecting Manning's Roughness Coefficient.

Most economical sections. Computation of Uniform flow, Normal depth.
Critical Flow: Specific energy – critical depth - computation of critical depth – critical, sub critical and super critical Flows-Channel transitions (Theory only).

UNIT - II

Open Channel Flow–II: Non-uniform flow–Gradually Varied Flow-Dynamic equation for G.V.F; Classification of channel bottom slopes–Classification and characteristics of Surface profiles– Computation of water surface profiles by Numerical and Analytical approaches. Direct step method.

Rapidly varied flow: Elements and characteristics (Length and Height) of Hydraulic jump in rectangular channel– Types, applications and location of hydraulic jump, Energy dissipation and other uses.

UNIT - III

Dimensional Analysis and Hydraulic Similitude: Dimensional homogeneity – Rayleigh's method and Buckingham's π methods–Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problems.

Basics of Turbo Machinery: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, Jet striking centrally and at tip, Velocity triangles at inlet and outlet, expressions for work done and efficiency.

UNIT - IV

Hydraulic Turbines – I: Elements of a typical Hydropower installation – Heads and efficiencies – Classification of turbines–Pelton wheel–Francis turbine–Kaplan turbine–working, working proportions, velocity diagram, work done and efficiency, hydraulic design. Draft tube – Classification, functions and efficiency.

Hydraulic Turbines–II: Governing of turbines–Surge tanks–Unit and specific turbines–Unit speed – Unit quantity – Unit power – Specific speed – Performance characteristics – Geometric similarity – Cavitation. Selection of turbines.

UNIT - V

Centrifugal Pumps: Pump installation details–classification–work done–Manometric head– minimum starting speed–losses and efficiencies–specific speed. Multistage pumps –pumps in series, parallel – performance of pumps – characteristic curves – NPSH – Cavitation.

TEXT BOOKS:

1. Fluid Mechanics by Modi and Seth, Standard Book House.
2. Fluid Mechanics and Hydraulic machines by Manish Kumar Goyal, PHI learning Private Limited, 2015
3. Fluid Mechanic & Fluid Power Engineering by D. S. Kumar (Kataria & Sons Publications Pvt. Ltd.).

REFERENCE BOOKS:

1. Fluid Mechanics by R.C. Hibbeler, Pearson India Education Services Pvt.Ltd
2. Introduction to Fluid Mechanics and Fluid Machines by S K Som, Gautam Biswas, Suman Chakraborty, Mc Graw Hill Education (India) Private Limited
3. Hydraulic Machines by Banga & Sharma (Khanna Publishers).
4. Open channel flow by V.T. Chow (McGraw Hill Book Company).