II B.Tech II Sem

## 15AME14-HYDRAULICS AND HYRAULIC MACHINERY

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**Objective:** The main objective of this course is to deal with the concepts of flow through open channels and their applications and the principles of hydraulic machines and hydraulic models.

**UNIT – I**

**Open Channel Flow-Uniform Flow:** Introduction, Classification of flows, Types of channels; Flow analysis: The Chezy equation, Empirical formulae for the Chezy constant, Hydraulically efficient channel sections: Rectangular, Trapezoidal, Triangular and Circular channels; Velocity distribution; Energy and momentum correction factors. Application of Bernoulli's equation to open channel flow.

**Open Channel Flow- Non – Uniform Flow:** Concept of specific energy; Specific energy curves; Critical flow; Critical flow in a rectangular channel; Critical slope; discharge curve, Different slope conditions; Channel transitions- Reduction in width of a rectangular channel, Raised bottom in a rectangular channel, venture flume, Momentum principle applied to open channel flow; Specific force; Specific force curve.

**UNIT – II**

**Open Channel Flow- Gradually Varied Flow:** Introduction, Dynamic equation; Dynamic equation for GVF in wide Rectangular channel, classification of channel bottom slopes, Surface Profiles; Characteristics of surface profiles, Back water Curves and Draw down curves; Examples of various types of water surface profiles; Control section, Computation of surface profiles by single step method.

**Open Channel Flow- Rapidly Varied Flow:** Hydraulic jump; Elements and characteristics of hydraulic jump; Hydraulic jump in rectangular channels, height and length of the jump, Energy loss in a hydraulic jump, Types of hydraulic jump; applications of hydraulic jump; Location of hydraulic jump,.

**UNIT – III**

**Impact Of Jets:** 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-Angular momentum principle, Torque and head transferred in roto dynamic machines.

**Hydraulic Turbines-I:** Introduction, head and efficiencies of hydraulic turbines, Classification of turbines; pelton wheel: parts, Velocity triangles, work done and efficiency, working proportions, design of pelton wheel. Radial flow reaction turbines: velocity triangles and work done for inward radial flow turbine, degree of reaction, discharge, speed ratio, flow ratio.

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**UNIT – IV**

**Hydraulic Turbines-II:** Francis turbine: main components and working, work done and efficiencies, design proportions; design of Francis turbine runner. Kaplan turbine: main components and working, working proportions. Draft tube: theory and efficiency; specific speed, unit quantities, characteristic curves of hydraulic turbines. Cavitation: causes, effects.

**Centrifugal Pumps:** Introduction, component parts and working of a centrifugal pump, work done by the impeller; heads, losses and efficiencies; minimum starting speed; Priming ;specific speed; limitation of suction lift, net positive suction head(NPSH);Performance and characteristic curves; Cavitation effects ;Multistage centrifugal pumps; troubles and remedies.

**UNIT – V**

**Dimensional Analysis And Similitude:** Introduction, dimensions; Dimensional homogeneity; Methods of dimensional analysis- Rayleigh's method; Buckingham – Pi theorem; model analysis; similitude-types of similarities; Dimensionless numbers; Model laws ;Partially submerged objects; types of models; Scale effect.

**Boundary Layer Theory& Drag And Lift:** Boundary layer – concepts, Prandtl's contribution, Characteristics of boundary layer along a thin flat plate, laminar and turbulent Boundary layers, separation of BL. expression for drag and lift; Lift and Drag Coefficients; pressure drag and friction drag; Streamlined and bluff bodies.

**Text Books** :


(1) Fluid Mechanics, Hydraulic and Hydraulic Machines by Modi & Seth, Standard book house.

(2) A text of Fluid mechanics and hydraulic machines by Dr.R.K.Bansal – Laxmi Publications (P) Ltd., New Delhi.


**References :**


(1) Fluid Mechanics & Fluid Machines by Narayana Pillai, universities press.

(2) Open channel flow by srinivasan, Oxford University Press

(3) Fluid Mechanics And Machenary-Kothandaraman, New Age Pubilishers

(4) Open Channel flow by K.Subramanya.Tata Mc.Grawhill Publishers.

(5) Elements of Open channel flow by Ranga Raju, Tata MC.Graw Hill, Publications.

(6) Fluid mechanics and fluid machines by Rajput, S.Chand & Co.

(7) Open Channel flow by V.T.Chow, Mc.Graw Hill book company

(8) Hydraulic Machines by Banga & Sharma Khanna Publishers.

(9) Fluid Mechanics & Fluid Power Engineering by D.S. Kumar Kataria & Sons.


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