GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

FLUID MECHANICS AND HYDRAULIC MACHINERY

Course Code: GR15A2028 L:3 T:1 P:0 C:4
II Year II Semester

Prerequisites: Engineering Mathematics, Fundamentals of Thermodynamics

Course Objectives
- To learn the fluid properties and fundamentals of fluid statics and fluid flow
- To introduce the concepts of flow measurements and flow through pipes
- To introduce the concepts of momentum principles
- To impart the knowledge on pumps and turbines

Course Outcomes
- An ability to know the definitions of fundamental concepts of fluid mechanics
- An ability to use conservation laws in integral form and apply them to determine forces and moments on surfaces of various shapes and simple machines
- An ability to use euler's and Bernouli's equations and conservation of mass to determine velocities, pressures and accelerations for incompressible and inviscid fluids
- Given the required flow rate and pressure rise, select the proper pump to optimize the pump efficiency.

Unit-1
Dimensions and units: physical properties of fluids- specific gravity, viscosity surface tension- vapour pressure and their influence on fluid motion- atmospheric gauge and vacuum pressure –measurement of pressure- Piezometer, U-tube and differential manometers.
Fluid Kinematics: Stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform, non uniform, laminar, turbulent, rotational and irrotational flows-equation of continuity for three dimensional flows.

Unit-II
Fluid Dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend. Steam function and Velocity potential

Unit-III
Internal and External Flows: Flow through tubes and plates -Shear stress and

velocity distributions- Navier-stokes equations of fluid motion(Explanation only)- Reynolds's experiment- Darcy-Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line. Measurement of flow: pilot tube, venture meter and orifice meter.

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 diagrams, work done and efficiency, flow over radial vanes. Elements of hydro electric power station-types-concept of pumped storage plants-storage requirements, mass curve (explanation only) estimation of power developed from a given catchment area; heads and efficiencies.

Unit-V

Hydraulic Turbines: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies , hydraulic design –draft tube theory- functions and efficiency. Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

Hydraulic Pumps: Classification, working, work done – manomertic head-losses and efficiencies specific speed- pumps in series and parallel-performance characteristic curves, NPSH. Reciprocating pumps : Working, Discharge, slip, indicator diagrams. Power required to drive the pump. Air vessels

Teaching Methodology

1. Power point Presentations, Working models, white board & marker

Text Books

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by R K Rajput.

Reference Books

1. luid Mechanics and Hydraulic machines by R K Bansal, Laxmi publications.
2. Fluid Mechanics & Hydraulic Machines : Problems & Solutions by K.Subrmanya /TMH private limited.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers.