FLUID MECHANICS AND HYDRAULIC MACHINERY

UNIT I - FLUID STATICS AND FLUID KINEMATICS

Introduction- Introduction to matters, Introduction to fluids, Distinguish between solid and Fluid, Fluid concept, Liquid and gas as a fluid, Mechanics, Fluid mechanics, History of fluid mechanics, Units and dimensions. **Properties of fluid -** Properties of fluid, Specific volume and specific weight, Specific gravity and temperature, Viscosity, Newton's law of viscosity, Compressibility, Surface tension, Capillarity, Vapour pressure. **Problems on properties of fluids** - Problems on properties of fluids. **Concept of fluid static pressure -** Fluid statics, Pressure, Hydrostatic Law, Pascal law, Pressure head, Pressure terminology, Problems on fluid static pressure. **Pressure measuring instruments -** Measurement of pressure, Simple manometers, U-tube manometer, Single column manometers, Differential manometers, Inverted U tube differential manometer. **Problems on manometer -** Problems on manometer. **Introduction to fluid kinematics -** Fluid kinematics, Types of flow, Scalar and vector fields, Velocity and acceleration field, Problem related to velocity and acceleration. **Continuity equation -** Rate of flow or discharge, Continuity equation, Continuity equation in three dimension, Problems on continuity equation. **Flow visualization -** Flow visualization, Stream lines, Path lines, Streak lines, Vortex flow. **Velocity potential and stream function -** Velocity potential function, Stream function, Relation between stream function and velocity potential function, Equipotential line and steam line, Flow net, Circulation and vorticity. **Problems on velocity potential function and stream function -** Problems on velocity potential function and stream function.

UNIT II - FLUID DYNAMICS AND CLOSED CONDUIT FLOW

Introduction to fluid dynamics- Introduction to fluid dynamics, Equations of motion, Euler equation of motion, Bernoulli's equation. **Problems on bernoullis equation** - Problems on bernoullis equation. **Application of bernoullies equation -** Applications of Bernoulli's equation, Venturimeter, Discharge through venturimeter, Orifice meter, Pitot tube, Flow nozzle. **Problems on application of bernoullies equation -** Problems on application of bernoullies equation. **Linear momentum equation -** The momentum equation, Momentum equation uses, Problem. **Reynold's Experiment -** Reynolds' experiment, Reynolds number, Significance of Reynolds number, Reynolds number for non newtonian fluids. **Flow through pipes -** Loss of energy in pipes, Major loss in pipe, Pipe roughness, Moody chart, Minor energy losses, Loss of head due to sudden enlargement, Loss of head due to sudden contraction, Loss of head at the entrance of a pipe, Loss of head at the exit of a pipe, Loss of head due to an obstruction in a pipe, Other minor losses in pipe, Hydraulic gradient and total energy. **Problems on losses of flow in pipe -** Problems on losses of flow in pipe. **Flow through pipes in series and parallel -** Flow through parallel pipes, Flow through pipes in series, Equivalent pipe, Problem on flow through pipes.

UNIT III - BASICS OF TURBO MACHINERY AND HYDROELECTRIC POWER STATIONS

Introduction - Introduction. **Force Exerted by a jet on a statinary plates -** Force exerted by the jet on a fixed vertical flat plate, Force exerted by the jet on a fixed inclined flat plate, Problem on impact of jets, Impact of jet on the fixed curved plates, Jet strikes the curved plate at one end tangentially when the plate is symmetrical. **Force Exerted by a jet on a moving plates -** Force exerted by jet on the moving plate, Moving flat plate arranged on rim, Problem on impact of jets, Force on the Curved Plate when the Plate is Moving in the Direction of Jet, Jet striking an unsymmetrical vane at one of its tips, Impact of Jet on a series of vanes fixed of a wheel, Force exerted on a series of radial curved vanes. **Hydroelectric power plant -** Introduction to hydro-electric power stations, Elements of hydroelectric power station, Working principle of hydro-electric power stations, Classification of Hydro-electric power station, Classification according to availability of water head, Medium head hydro electric power plants, High head hydro electric power plants, Classification according to type of load supplied, Classification of hydel power stations on the basis of hydraulic considerations, Pumped storage plants, Classification of hydro-electric power plants on the basis of location, Main requirements of high-head hydroelectric power station.

UNIT IV - HYDRAULICS TURBINES AND PERFORMANCE

Introduction to turbine- Introduction, Water turbines installed in India, Hydraulic terms, Derivation of water power equation, Classification of hydraulic turbine. **Pelton Wheel turbine -** Pelton wheel turbine,
Velocity triangle for pelton wheel turbine, Problem on pelton Wheel turbine. **Francis and kaplan turbine -** Francis turbine, Velocity triangle for francis turbine, Problem on francis turbine, Kaplan turbine, Problem on Kaplan turbine. **Draft tube -** Draft tube, Draft tube theory, Efficiency of Draft Tube, Problems on Draft tube. **Turbine specification and characteristics -** Specific speed, Characteristics curves of hydraulic turbine, Comparison between Impuse and reaction turbine, Comparison between francis and kaplan turbine, Governing of water turbine, Governing of pelton wheel (Impulse turbine), Governing of francis turbine, Model analysis for turbine, Selection of type of turbine, Cavitation in reaction turbines, Surge tank, Types of Surge tank.

UNIT V - CENTRIFUGAL PUMP

Introduction - Introduction to pumps, Classification of pumps. **Centrifugal pump -** Centrifugal pump, Construction of centrifugal pump, Working of centrifugal pump, Multistage centrifugal pump. **Performance of centrifugal pump -** Priming of centrifugal pump, Cavitation of centrifugal pump, Workdone by centrifugal pump, Head and efficiency of centrifugal pump, Characteristics curves of centrifugal pump, Model analysis for Centrifugal pump, Net Positive Suction Head, Water hammer. **Problems on centrifugal pump -** Problems on centrifugal pump.