31062   HYDRAULICS

DETAILED SYLLABUS

Unit I

1.1 INTRODUCTION

Hydraulics – Definition - Properties of fluids - Mass, force, weight, specific volume, specific gravity, specific weight, density, relative density, compressibility, viscosity, cohesion, adhesion, capillarity and surface tension - Dimensions and Units for area, volume, specific volume, velocity, acceleration, density, discharge, force, pressure and power.

1.2 MEASUREMENT OF PRESSURE

Pressure of liquid at a point – Intensity of pressure - Pressure head of liquid – Conversion from intensity of pressure to pressure head and vice-versa - Formula and Simple problems - Types of pressures - Static pressure, Atmospheric pressure, Gauge pressure, Vacuum pressure and Absolute pressure – Simple problems - Measurement of pressure - Simple mercury barometer - Pressure measuring devices- Piezometer tube - Simple U-tube manometer - Differential manometer – Micrometre - Problems.

1.3 HYDROSTATIC PRESSURE ON SURFACES

Pressure on plane surfaces - Horizontal, vertical and inclined surfaces-Total pressure-Centre of pressure - Depth of centre of pressure - Resultant pressure – Problems on Practical application - Sluice gates, Lock gates and Dams-Descriptions.

Unit II

2.1   FLOW OF FLUIDS

Types of flow – Laminar and turbulent flow - Steady and unsteady flow – Uniform and Non-uniform flow - Equation for continuity of flow (law of conservation of mass) – Energy possessed by a fluid body - Potential energy and Potential Head – Pressure energy and Pressure Head - Kinetic Energy and Kinetic Head - Total Energy and Total Head – Bernoulli's theorem – (No proof) – Problems on Practical   applications   of Bernoulli's   theorem – Venturimeter - Orificemeter (Derivation not necessary) - Simple problems.

2.2 FLOWS THROUGH ORIFICES AND MOUTHPIECES

Definitions- Types of orifices - Vena contracta and its significance – Hydraulic coefficients Cd, Cv and Cc - Formula - Simple problems - Large orifice – Definition – Discharge formula – Simple problems - Practical applications of orifices – Types of mouthpieces - External and internal mouthpieces - Discharge formula - Simple problems.

2.3 FLOWS THROUGH PIPES

Definition of pipe-Losses of head in pipes – Major losses - Minor losses - Sudden enlargement, sudden contraction, obstruction in pipes (no proof) - Simple problems – Energy / Head losses of flowing fluid due to friction - Darcy's equation - Chezy's equation (No derivation) – Problems - Transmission of power through pipes – Efficiency - Pipes in parallel connected to reservoir - Discharge formula - Simple problems.

Unit III

3.1 FLOWS THROUGH NOTCHES

Definitions- Types of notches – Rectangular, Triangular and Trapezoidal notches – Derivation of equations for discharges - Simple problems - Comparison of V-Notch and Rectangular Notch.

3.2 FLOWS THROUGH WEIRS

Definitions - Classification of weirs - Discharge over a rectangular weir and trapezoidal weir – Derivation – Simple problems – End contractions of a weir – Franci's and Bazin's formula – Simple problems - Cippoletti weir – Problems - Narrow crested weir – Sharp crested weir with free over fall - Broad crested weir - Drowned or Submerged weirs - Suppressed weir - Stepped weir – Problems - Definition of terms - Crest of sill, Nappe or Vein, Free discharge - Velocity of approach – Spillways and Siphon spillway - Definition.

Unit IV

4.1 FLOWS THROUGH OPEN CHANNELS

Definition - Classification - Rectangular and Trapezoidal channels – Discharge – Chezy's formula, Bazin's formula and Manning's formula - Hydraulic mean depth – Problems - Conditions of rectangular/trapezoidal sections - Specific energy, critical depth –Conditions of maximum discharge and maximum velocity - Problems - Flow in a venturiflume –Uniform flow in channels – Flow through a sluice gate – Types of channels – Typical crosssections of irrigation canals - Methods of

measurements of velocities – Channel losses - Lining of canals – Advantages of lining of canals - Types of lining- Cement concrete lining with sketches - Soil cement lining with sketches – LDPE lining.

Unit V

5.1 GROUND WATER

Aquifer - Water table – Exploring the availability of ground water - Taping of ground water - Open well - Bore well-Types of well construction - Yield of a open well – Equation - Specific capacity or specific yield of a well -Test for yield of well – Methods of rain water harvesting - Sanitary protections – No problems.

5.2 PUMPS

Pumps – Definition – Difference between a pump and a turbine- Classification of pumps - Positive displacement pumps and rotodynamic pressure pumps - Characteristics of modern pumps Maximum recommended suction, lift and power consumed- Reciprocating pump - Construction detail and working principle - Types - Single acting and Double acting -Slip -Air vessels Discharge and Efficiency- Problems - Centrifugal pump – Advantages and disadvantages over a reciprocating pump - Layout -Construction details – Priming of centrifugal pump – Working of the pump – Classification – Functions of Foot valve, Delivery valve and Non-return valve – Fundamental equation of centrifugal pump - Characteristics of a centrifugal pump – Discharge, power and efficiency - Problems - Specifications of centrifugal pumps and their sections- Hand pump - Jet pump- Deep well pump - Plunger pumps - Piping system.

Reference Book: 1. Dr. Jagadish Lal - Hydraulics, Fluid Mechanics and Hydraulic MachinesMetropolitan Book 2. Company- New Delhi 3. P.N. Modi & S.M. Sethi - Fluid Mechanics - Standard Publishers – New Delhi 4. S. Ramamirtham-Hydraulics,Fluid Mechanics and Hydraulics Machines- Dhanpat Rai & Sons, New Delhi 5. K.L.Kumar - Fluid Mechanics – Eurasa Publshing House – New Delhi 6. R.K. Bansal - Fluid Mechanics - Lakshmi Publications 7. Prof. S. Nagarathinam - Fluid Mechanics - Khanna Publishers – New Delhi 8. K.R. Arora - Hydraulics, Fluid Mechanics and Hydraulics Machines –Standard Publishers & Distributors,   New Delhi 9. B C S Rao, "Fluid Mechanics and Machinery" Tata-McGraw-Hill Pvt. Ltd., New Delhi