

# AMS03 HYDRAULICS

## UNIT-1 INTRODUCTION

- 1.1 Introduction, Classification of Fluid, Fundamental Units, S.I. (International System of Units),
- 1.2 Presentation of Units and their Values, Rules for S.I. Units, Liquids and their properties,
- 1.3 Density of Water, Specific weight of Water, Specific Gravity of Water,
- 1.4 Compressibility of Water, Surface tension of water, Capillarity of Water, Viscosity of Water.

## UNIT-2 HYDROSTATICS

- 2.1 Total Pressure, Total Pressure on an Immersed Surface, and Total Pressure on a Horizontally Immersed Surface,
- 2.2 Total pressure on a Vertically Immersed Surface, Total Pressure on inclined surface, Centre of pressure, Pressure on a curved Surface.

## UNIT-3 EQUILIBRIUM OF FLOATING BODIES

- 3.1 Archimedes Principle, Buoyancy, Centre of Buoyancy, Metacentre, Metacentric Height, Analytical Method for Metacentric Height,
- 3.2 Conditions of Equilibrium of a floating Body, Stable Equilibrium, Unstable Equilibrium, Unstable Equilibrium, Neutral Equilibrium,
- 3.3 Maximum Length of Vertically Floating Body, Conical Buoys Floating in Liquid, Experimental method for Metacentric Height, Time of Rolling (Oscillation) of a floating body.

## UNIT-4 BERNOULLI'S EQUATION AND ITS APPLICATIONS

- 4.1 Energy of a liquid in Motion, Potential Energy of a liquid particle in Motion, Kinetic Energy of a liquid particle in Motion, Pressure Energy of a liquid particle in Motion,
- 4.2 Total Energy of a liquid particle in Motion, Total Head of a liquid particle in Motion,
- 4.3 Bernoulli's Equation, Euler's Equation for Motion, Limitations, Practical Applications of Bernoulli's Equation,
- 4.4 Venturimeter, Discharge through a Venturimeter, Inclined Venturimeter, Orifice Meter, Pitot tube.

## UNIT-5 FLOW THROUGH ORIFICES

- 5.1 Types of Orifices, Jet of Water, Vena Contracta, Hydraulic Coefficients, Coefficient of Velocity, Coefficient of Discharge, Coefficient of Resistance,
- 5.2 Experimental Method for Hydraulic Coefficients, Discharge through a small Rectangular Orifice, Discharge through a large Rectangular Orifice,
- 5.3 Discharge through a Submerged or Drowned Orifice, Discharge through a Wholly Drowned Orifice, Discharge through a Partially Drowned Orifice,
- 5.4 Discharge through a Drowned Orifice under Pressure.

## UNIT-6 FLOW THROUGH MOUTHPIECES

- 6.1 Types of mouthpieces, Loss of a Head of a Liquid Flowing in a pipe, Loss of Head due to Sudden Enlargement, Loss of Head due to sudden contraction,

- 6.2 Loss of Head at entrance to pipe, Discharge through a Mouthpiece, Discharge through an External mouthpiece,
- 6.3 Discharge through an Internal mouthpiece (Re-entrant or Borda's mouthpiece), Discharge through a Convergent Mouthpiece,
- 6.4 Discharge through a Convergent-divergent Mouthpiece (Bell-mouthpiece), Pressure in a mouthpiece, Pressure in an External mouthpiece,
- 6.5 Pressure in an internal mouthpiece, Pressure in a Convergent Mouthpiece, Pressure in a Convergent-divergent Mouthpiece.

### **UNIT-7 FLOW THROUGH SIMPLE PIPES**

- 7.1 Loss of Head in Pipes, Darcy's Formula for loss of Head in pipes, Chezy's Formula for Loss of Head in Pipes,
- 7.2 Graphical Representation of Pressure Head and Velocity Head, Hydraulic Gradient Line, Total Energy Line, Transmission of Power through Pipes,
- 7.3 Time of Emptying a Tank through a Long Pipe, Time of Flow from One Tank into Another through a Long Pipe.

### **UNIT-8 UNIFORM FLOW THROUGH OPEN CHANNELS**

- 8.1 Chezy's Formula for Discharging through an Open Channel, Values of Chezy's Constant in the formula for Discharge through an Open Channel, Bazin's Formula for Discharge,
- 8.2 Kutter's Formula for Discharge, Manning's Formula for Discharge, Discharge through a Circular Channel, Channels of Most Economical Cross-sections,
- 8.3 Condition for Maximum Discharge through a Channel of Rectangular Section, Condition for Maximum Discharge through Channel of Trapezoidal Section,
- 8.4 Condition for Maximum Velocity through a Channel of Circular Section, Condition for Maximum Discharge through a Channel of Circular Section,
- 8.5 Measurement of River Discharge, Area of Flow, Simple Segments Method, Simpson's rule, Average Velocity of Flow, Floats, Pitot Tube, Chemical Method for the Discharge of a River.

### **UNIT-9 VISCOUS FLOW**

- 9.1 Viscosity, Newton's Law of Viscosity, Effect of Viscosity on Motion, Units of Viscosity, Effect of Temperature on the Viscosity, Kinematic Viscosity,
- 9.2 Classification of Fluids, Ideal Fluid, Real Fluid, Newtonian Fluid, Non-Newtonian Fluid, Ideal Plastic fluid,
- 9.3 Classification of Viscous Flows, Laminar Flow, Turbulent Flow, Reynold's Experiment of Viscous Flow, Reynold's number,
- 9.4 Hagen-Poiseuille Law for Laminar Flow in Pipes, Distribution of Velocity of a Flowing Liquid over a Pipe Section, Loss of Head due to Friction in a Viscous Flow.

### **UNIT-10 IMPACT OF JETS**

- 10.1 Force of Jet Impinging Normally on a fixed Plate, Force of Jet Impinging on an Inclined Fixed Plate, Force of Jet Impinging on a Curved Plate, Force of Jet Impinging on a Moving Plate,
- 10.2 Force of Jet Impinging on a Series of Moving Vanes,

10.3 Force of Jet Impinging on a Fixed Curved Vane, Force exerted NY a Jet of water on a series of vanes.

### **UNIT-11 JET PROPULSION**

11.1 Pressure of Water due to Deviated Flow, Principle of Jet Propulsion, Conditions for maximum efficiency, Propulsion of Ships by water Jets,

11.2 Propulsion of Ships Having Inlet Orifices at Right Angles to the Direction of its Motion (i.e. Orifices Amid ship), Propulsion of Ships Having Inlet Orifices Facing the Direction of Flow.

### **UNIT-12 WATER WHEELS**

12.1 Hydroelectric Power Plant, Heads of Turbine, Classification of Hydraulic Turbines, Water Wheels, Pelton

### **UNIT-13 IMPULSE TURBINES**

13.1 Pelton Wheel, Runner and Buckets, Casing, Braking Jet, Work Done by an Impulse Turbine, Design of Pelton Wheels,

13.2 Governing of an Impulse Turbine (Pelton Wheel), Other Impulse Turbines.

### **UNIT-14 CENTRIFUGAL PUMPS**

14.1 Types of Pumps, Centrifugal Pump, Types of casings for the impeller of a Centrifugal Pump, Volute Casing (Spiral Casing), Vortex Casing,

14.2 Volute Casing with Guide Blades, Work done by a Centrifugal Pump, Efficiencies of a Centrifugal Pump, Manometric Efficiency, Mechanical Efficiency.

### **UNIT-15 PUMPING DEVICES**

15.1 Hydraulic Ram, Air Lift Pump, and Rotary Pump.

### **UNIT-16 HYDRAULIC SYSTEMS**

16.1 Hydraulic Press, Hydraulic Accumulator, Hydraulic Intensifier, Hydraulic Crane, Hydraulic Lift, Direct Acting Hydraulic Lift,

16.2 Suspend Hydraulic Lift, Hydraulic Coupling, And Hydraulic Torque Convertor.

### **Reference Books:**

1. Open Channel Hydraulics by R H French
2. Experiments in Hydraulic Engineering by Sarbjit Singh
3. Fundamentals of Hydraulic Engineering Systems by Ned H C Hwang