

# AMSV03 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

- 1.1 Total Pressure, Total Pressure on an Immersed Surface, and Total Pressure on a Horizontally Immersed Surface,
- 1.2 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, Force of Jet Impinging on a Fixed Curved Vane, Force exerted NYa 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 Amidship), 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 Converter.

### **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