Summary :

1. Fundamentals of Pumping and Fluid Mechanics

- Basic hydraulic principles
- Definitions: head, flow rate, pressure, velocity, power
- Pump efficiency and performance parameters
- Net Positive Suction Head (NPSH)
- Cavitation fundamentals

2. Centrifugal Pumps

2.1 Operating Principles

- Energy transfer from impeller to fluid
- Velocity and pressure conversion

2.2 Hydraulic Design

- Impeller types (open, semi-open, closed)
- Radial, mixed-flow, and axial-flow designs
- Volute and diffuser casings

2.3 Performance Characteristics

- Head–capacity curves
- Efficiency curves

- Power curves

- Specific speed

2.4 Mechanical Design

- Shaft design

- Bearings and lubrication

- Sealing systems (packing and mechanical seals)

2.5 Cavitation and Suction Performance

- Causes and effects

- NPSH requirements

- Prevention methods

3. Positive Displacement Pumps

3.1 Reciprocating Pumps

- Piston and plunger types

- Valve operation

- Pulsation control

3.2 Rotary Pumps

-Gear pumps

- Screw pumps

- Vane pumps

- Lobe pumps

- 3.3 Applications and Selection Criteria

- High-pressure systems

- Accurate flow delivery

- Comparison with centrifugal pumps

4. Pump Materials and Construction

- Materials for corrosive fluids

- Abrasion resistance

- High-temperature applications

- Special alloys and coatings

5. Pump System Analysis

5.1 System Head Curves

- Static head

- Friction losses

- Operating point determination

5.2 Pumps in Series and Parallel

- Performance modification

- Load sharing

5.3 Transients and Surge

- Water hammer
- System protection

6. Installation and Alignment

- Foundation requirements
- Shaft alignment
- Piping considerations
- Start-up procedures

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7. Operation and Maintenance

- Preventive maintenance
- Vibration analysis
- Common failures and troubleshooting
- Reliability improvement

8. Testing and Standards

- Performance testing procedures
- Acceptance tests

- Industry standards compliance

9. Special Applications

- Power plants
- Petroleum industry
- Chemical processing
- Water supply and wastewater
- Nuclear service