UNIT II: Steam Nozzles and Turbines

Course Topics

- Flow through nozzles
- Critical pressure ratio
- Impulse & Reaction turbines
- Compounding
- Governing

Technical Terms

- Wet steam
- Dry saturated steam
- Superheated steam
- Degree of superheat
- Nozzle

Steam Nozzles

- Duct of varying area
- Converts pressure energy into kinetic energy
- Increases steam velocity

Flow Through Nozzles

- Adiabatic expansion
- Enthalpy decreases
- Velocity increases
- Friction effects

Types of Nozzles

- Convergent
- Divergent
- Convergent-Divergent

Supersaturated Flow

- Delayed condensation
- Metastable flow
- Wilson line concept

Critical Pressure Ratio

- Maximum discharge condition
- Sonic flow
- Choked flow

Effect of Friction

- Entropy increases
- Available energy decreases
- Velocity decreases

Steam Turbines

- Impulse turbine
- Reaction turbine

Impulse Turbine

- Pressure constant across moving blades
- Kinetic energy converted to work

Reaction Turbine

- Pressure drops in fixed and moving blades
- Works on reaction principle

Compounding of Turbines

- Reduces turbine speed
- Improves efficiency

Velocity Compounding

- Curtis stage
- Multiple blade rows

Pressure Compounding

- Pressure drop split into stages

Pressure-Velocity Compounding

- Combination of pressure and velocity compounding

Velocity Diagrams

- Used for turbine performance analysis

Governing of Steam Turbines

- Throttle governing
- Nozzle governing
- By-pass governing

Throttle Governing

- Controls steam flow
- Maintains turbine speed

Nozzle Governing

- Nozzles grouped and controlled by valves

Conclusion

- Steam nozzles and turbines are essential for efficient power generation