

**Program of the Entrance Examination for the
Master's Degree Programmes "Energy Technology" and
"Power Plant Engineering"**

Thermodynamics and Heat Transfer

Fundamentals: Basic Concepts and Definitions (System, State, Phase, Equilibrium, Temperature); The First Law of Thermodynamics, Work, Enthalpy, Heat; The Second Law of Thermodynamics, Entropy; Types of Systems (open, closed, adiabatic, isolated), Ideal Gas Model; Thermodynamic Equilibrium; Vapor and Gas Power Cycles: Rankine and Brayton Cycle, Cycles of Internal Combustion Engines, Carnot Cycle, Stirling Cycle; Refrigeration Cycle; Organic Rankine Cycle; Heat Engine Efficiency; Reversible and Irreversible Processes; Gibbs Free Energy; The Basics of Heat Transfer: Heat Transfer by Convection, Heat Transfer by Radiation, Heat Transfer by Conduction.

Chemical Thermodynamics

Classification of Fuels; Solid Fuels, Liquid Fuels, Gaseous Fuels; Ultimate and Proximate Analysis; Combustion Equations; Theoretical Air and Excess Air; Stoichiometric Air Fuel (A/F) Ratio; How to Convert Volumetric Analysis to Weight Analysis; How to Convert Weight Analysis to Volumetric Analysis; Analysis of Flue Gases; Internal Energy and Enthalpy of Reaction; Enthalpy of Formation; Higher and Lower Heating Values of Fuels; Determination of Heating Values of Solid, Liquid and Gaseous Fuels; Adiabatic Flame Temperature; Chemical Equilibrium.

Turbomachinery

Classification of Pumps;

Gas Turbine Theory and Construction:

Thermodynamics of Gas Turbines; Types of Gas Turbines; Basic Components of Gas Turbine; Principle of Operation and Design of Gas Turbines; Gas Turbine Efficiency;

Compressor Types; Compressor Efficiency;

Combustion Chambers;

Steam Turbines:

Thermodynamics of Steam Turbines: Rankine Cycle, Rankine Cycle with Reheat, Rankine Cycle with Superheat, Regenerative Rankine Cycle; Types of Steam Turbines (Single-Stage Turbines, Multi-Stage Turbines); Principle of Operation and Design; Turbine Efficiency; Description of h-S chart (Enthalpy-Entropy chart).

Thermal Power Plants

Classification of Thermal Power Plants: by Fuel, by Prime Mover, by Duty; Steam and Gas Turbine Cycles for Power Generation; Schematic Diagram of a Condensing Steam Turbine Power Plant; Schematic Diagram of a CHP (Combined Heat and Power) Plant; Heat Recovery Steam Generator; Power from Renewable Energy.

Energy Systems

Energy Sector and Sustainable Human Development; the Major Consumers of Heat and Electricity.

Ecology

The main Pollutants from the Industrial Sector; Air Pollution Control Systems in Industry; Pollution Prevention.

Programmes Coordinator

Vitaly V. Sergeev