ESO 201A/202 THERMODYNAMICS

SI Units, Definitions & Concepts: System, Property, Energy, Thermodynamic Equilibrium, Work interaction & various modes of work, Heat, State Postulate, Zeroth Law of Thermodynamics, Temperature Scale, IPTS.

Thermodynamic Properties of Fluids: Pure substance. Phase, Simple compressible substance, Ideal gas Equation of state, van der Waals Equation of State; Law of corresponding states, Compressibility chart, Pressure-volume; Temperaturevolume and Phase diagrams; Mollier diagram and Steam tables.

First Law of Thermodynamics & its consequences, Applications of First Law for elementary processes, First Law analysis of Non-flow processes; Use of steam tables &Mollier diagram, Application of First Law of Thermodynamics for Flow Process-Steady state, steady flow processes, Throttling process; Transient Flow Processes-Charging & discharging of tanks.

First Law Applications to Chemically Reacting Systems: Fuels & Combustion, Theoretical Air/Fuel ratio, Standard heat of Reaction and effect of temperature on standard heat of reaction, Adiabatic flame temperature.

Second Law of Thermodynamics & its Applications: Limitations of the First Law of Thermodynamics, Heat Engine, Heat Pump/Refrigerator. Second Law of Thermodynamics - Kelvin Planck and Clausius statements & their equivalence, Reversible & irreversible processes, Criterion of reversibility, Carnot cycle & Carnot principles, Thermodynamic Temperature scale, Clausius inequality, Entropy, Calculations of entropy change, Principle of entropy increase, T- S diagram, II Law analysis of Control volume.

Thermodynamic Potentials; Maxwell relations; Available energy, Availability; Second law efficiency. Thermodynamic relations, Jacobian methods, Clapeyron and Kirchoff equations, Phase rule.

Power Cycles: Rankine cycle- Ideal, Reheat and Regenerative Rankine cycles. Gas Power Cycles: Otto cycle, Diesel cycle, Dual cycle and Brayton cycle, Refrigeration Cycles: Vapor compression refrigeration, Absorption refrigeration and Gas refrigeration Cycles.