631. CHEMICAL TECHNOLOGY/CHEMICAL ENGINEERING

1. **Process Calculations and Thermodynamics:** Laws of conservation of mass and energy use of the components: recycle, bypass and purge calculations: degree of freedom analysis first and Second laws of thermodynamics. First law application to close and open systems. Second law and Entropy thermodynamic properties of pure substances equation of state and departure function. Properties of mixtures: partial molar properties, fugacity, excess properties and activity coefficients, phase equilibria: VLE of systems: chemical reaction equilibria.

2. **Fluid Mechanics and Mechanical Operations:** Fluid statics, Newtonian and non-Newtonian fluids, Bernouoli equation. Macroscopic friction factors, energy balance, dimensional analysis, shell balances, flow through pipeline systems, flow meters, pumps and compressors, packed and fluidized beds; elementary boundary layer theory size reduction and size separation; free and hindered settling; thickening and classification, filtration mixing and agitation.

3. **Heat Transfer:** Conduction, convection and radiation: heat transfer coefficient, steady and unsteady heat conduction, boiling, condensation and evaporation; types of head exchangers.

4. **Mass Transfer:** Fick's laws, molecular diffusion in fluid, mass transfer coefficients, stage wise and continuous contacting and stage efficiencies; HTU & NTU concepts, design and operation of equipment for distillation absorption liquid–liquid extraction, drying, humidification, dehumidification and adsorption.

5. **Chemical Reaction Engineering:** Theories of reaction rates, kinetics of homogeneous reactions, interpretation of kinetic data, single and multiple reactions in ideal reactors, non-isothermal reactors.

6. **Instrumentation and Process Control:** Measurement of process variables, sensors, transducers and their dynamics, transfer functions and dynamic response of simple systems, process reaction curve, controller modes (P, PI and PID); control valves; analysis of closed loop systems including stability, frequency response and controller tuning, cascade, fee forward control.

MODEL OF EXAMINATION

The Ph.D. Eligibility Test comprises of 100 objective type questions and the duration of examination is 90 minutes.

MODEL QUESTIONS

1. Operating velocity (V) in a packed tower is related to flooding velocity (VF) by
   a) V – 0.5(VF) b) V = (VF) c) V = 2(VF) d) V = 0.01(VF)
2. Tooth paste is an example of
   a) Newtonian Fluid b) Bingham plastic
   b) c) Power-law fluid d) Thixotropic fluid
3. Stokes Law for settling spherical particles implies
   a) Zero form drag b) 2/3 of total drag
   b) c) 1/3 of total drag d) Total drag
4. Reynolds analogy is for a Prandtl number of
   a) 10 b) ∞ c) Zero d) 1
5. The phase equilibrium criteria imply equality of
   a) Temperature b) Pressure
   c) Chemical Potential d) All the preceding three properties