Dr. Babasaheb Ambedkar Marathwada University Aurangabad
Syllabus for Ph.D. Entrance Test (PET) 2016
Under Faculty of Engineering & Technology
Subject: Chemical Engineering

Section - A: Research Methodology

Unit-I

Objectives of Research, Research Approaches, Significance of Research, Types of Research, Research Process, Criteria of Good Research, Defining the Research Problem, Selecting the Problem, Technique Involved in Defining a Problem, Methods and Tools in Research, Qualitative and Quantitative Studies, Inquiry Forms, Questionnaire, Developing a Research Plan, Literature review, Use of Library, Books and Journals, Use of Internet (Different useful sites), Patent Search

Unit-II

Data analysis, Types of data, Parametric and Non-parametric Data, Basic Concepts of Probability, Probability Axioms, Analysis and Treatment of Data, Measures of Central Tendency, Measures of Dispersions, Measures of Symmetry, Measures of Peakedness.

Unit-III

Regression Analysis – Simple Linear Regression, Multiple linear Regression, Correlation and Regression Analysis, Tests of Hypothesis and Goodness of Fit: Definition of null and alternative hypothesis, students 't' distribution, Chi-square distribution, F-test

Unit-IV

Interpretation and Report Writing: Meaning of Interpretation, Techniques of Interpretation, Significance of Report Writing, Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Parts of Dissertation/Thesis writing, Different Styles of Dissertation/Thesis writing

Unit-V

Sources of procurement of Research Grants, Development of Research Proposal, Industry Institute Interaction, Writing a technical paper, Plagiarism and its Implications.

Section - B

Unit 1: Process Calculations and Fluid Mechanics

Steady and unsteady state mass and energy balances including multiphase, multi- component, reacting and non-reacting systems. Use of tie components; recycle, bypass and purge calculations; Gibb's phase rule and degree of freedom analysis.

Fluid statics, Newtonian and non-Newtonian fluids, shell-balances including differential form of Bernoulli equation and energy balance, Macroscopic friction factors, dimensional analysis and similitude, flow through pipeline systems, flow meters, pumps and compressors, elementary boundary layer theory, flow past immersed bodies including packed and fluidized beds, Turbulent flow: fluctuating velocity, universal velocity profile and pressure drop.

Unit 2: Heat Transfer and Mass Transfer operation

Steady and unsteady heat conduction, convection and radiation, thermal boundary layer and heat transfer coefficients, boiling, condensation and evaporation; types of heat exchangers and evaporators and their process calculations. Design of double pipe, shell and tube heat exchangers, and single and multiple effect evaporators.

Fick's laws, molecular diffusion in fluids, mass transfer coefficients, film, penetration and surface renewal theories; momentum, heat and mass transfer analogies; stage-wise and continuous contacting and stage efficiencies; HTU & NTU concepts; design and operation of equipment for distillation, absorption, leaching, liquid-liquid extraction, drying, humidification, dehumidification and adsorption.

Unit 3: Chemical Reaction Engineering and Process Control

Theories of reaction rates; kinetics of homogeneous reactions, interpretation of kinetic data, single and multiple reactions in ideal reactors, non-ideal reactors; residence time distribution, single parameter model; non-isothermal reactors; kinetics of heterogeneous catalytic reactions; diffusion effects in catalysis.

Measurement of process variables; sensors, transducers and their dynamics, process modeling and linearization, transfer functions and dynamic responses of various systems, systems with inverse response, process reaction curve, controller modes (P, PI, and PID); control valves; analysis of closed loop systems including stability, frequency response, controller tuning, cascade and feed forward control.

Unit 4: Chemical Technology and Plant Design and Economics

Inorganic chemical industries (sulfuric acid, phosphoric acid, chlor-alkali industry), fertilizers (Ammonia, Urea, SSP and TSP); natural products industries (Pulp and Paper, Sugar, Oil, and Fats); petroleum refining and petrochemicals; polymerization industries (polyethylene, polypropylene, PVC and polyester synthetic fibers).

Principles of process economics and cost estimation including depreciation and total annualized cost, cost indices, rate of return, payback period, discounted cash flow, optimization in process design and sizing of chemical engineering equipments such as compressors, heat exchangers, multistage contactors.

Unit 5: Thermodynamics and Mechanical Operation

First and Second laws of thermodynamics. Applications of first law to close and open systems. Second law and Entropy. Thermodynamic properties of pure substances: Equation of State and residual properties, properties of mixtures: partial molar properties, fugacity, excess properties and activity coefficients; phase equilibria: predicting VLE of systems; chemical reaction equilibrium.

Particle size and shape, particle size distribution, size reduction and classification of solid particles; free and hindered settling; centrifuge and cyclones; thickening and classification, filtration, agitation and mixing; conveying of solids.