Bharati Vidyapeeth University

College of Engineering

Department of Chemical Engineering

Part 1

PhD: Common Entrance Test (CET)

BHARATI VIDYAPEETH DEEMED UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

Ph. D. Entrance Test Syllabus

Section I: Research Methodology

Topics covered

Introduction to Research: The concept of research, characteristics of good research, Application of Research, Meaning and sources of Research problem, characteristics of good Research problem, Research process, outcomes, application of Research, Meaning and types of Research hypothesis, Importance of Review of Literature, Organizing the Review of Literature.

Types of Research : Types of research, pure (basic, fundamental) and applied research, qualitative and quantitative.

Research Design : Meaning, need, types of research design – Exploratory, Descriptive, Casual research Design, Components of research design, and Features of good Research design. Experiments, surveys and case study Research design.

Sampling, Data Collection and analysis : Types and sources of data – Primary and secondary, Methods of collecting data, Concept of sampling and sampling methods – sampling frame, sample, characteristics of good sample, simple random sampling, purposive sampling, convenience sampling, snowball sampling, classification and tabulation of data, graphical representation of data, graphs and charts – Histograms, frequency polygon and frequency curves, bell shaped curve and its properties.

Statistical Methods for Data Analysis : Applications of Statistics in Research, measures of central tendency and dispersion

Research Report : Research report and its structure, journal articles – Components of journal article. Explanation of various components. Structure of an abstract and keywords. Thesis and dissertations . components of thesis and dissertations. Referencing styles and bibliography.

Ethics in Research - Plagiarism - Definition, different forms, consequences, unintentional plagiarism, copyright infringement, collaborative work. Qualities of good Researcher.

ICT Tools for Research : Role of computers in research, maintenance of data using software such as Mendeley, Endnote, Tabulation and graphical presentation of research data and software tools.

Web search : Introduction to Internet, use of Internet and WWW, using search engines and advanced search tools.

∗**The syllabus of Research Methodology will be common for all the subject except Law**

RECOMMENDED BOOKS

1	Donald Cooper and PS Schindler (2009)	Business Research Methods, 9th edition, Tata McGraw Hill.
2	Kothari C. R	Research Methodology
3	Uma Sekaran (2010)	Research Methods for Business, 4th edition, Wiley.
4	Ranjit Kumar (2009)	Research Methodology, 2nd edition, Pearson Education
5	Naresh Malhotra and S Dash (2009)	Marketing Research, 5th edition, Pearson Prentice Hall.
6	Michael V. P	Research Methodology.
7	Fred N. Kerlinger :	Foundations of Behavioral Research.

Part 2

PhD Course work

	BHARATI VIDYAPEETH DEEMED UNIVERSITY **FACULTY OF ENGINEERING AND TECHNOLOGY** **Ph. D. Entrance Test Syllabus**
	Specific Subject: Chemical Engineering
	Topics covered
UNIT-I	**Fluid Flow Operations:** Fluid Statics; Newtonian and non-Newtonian fluid behavior; Flow of incompressible fluids in pipe: friction factor, Hagen Poisuille equation; Flow of compressible fluids: Processes of compressible flow, adiabatic frictional flow, isothermal frictional flow; Flow past immersed bodies: drag and drag coefficient, Kozeny-Carman equation, motion of particles through fluids, Fluidization: Conditions for fluidization, minimum fluidization velocity, applications of fluidization; Two phase flow: Gas/liquid, liquid/liquid and gas/solid flow, flow types and regimes in horizontal and vertical flow, regime map, behavior of non-Newtonian fluids in two phase flow.
UNIT-II	**Chemical Engineering Thermodynamics:** Introduction to molecular thermodynamics of fluid phase equilibrium; Fundamentals concepts of statistical thermodynamics; Classical thermodynamics of phase equilibrium:open and closed systems, Gibbs-Duhem equation, chemical potential, fugacity and activity; Thermodynamic properties from volumetric data/fugacities at moderate pressure, fugacity of pure liquid or solid; Fugacities in gas mixtures: Virial equation of state, fugacities from Virial equation, third Virial coefficient, chemical interpretation of deviation from gas phase ideality, fugacities at high pressure, cubic equation of state, solubility of solids and liquids in compressed gas; Fugacities in liquid mixture: excess properties, models for excess Gibbs energy, activity and activity coefficient, thermodynamic consistency of experimental equilibrium data; Intermolecular forces and the theory of corresponding states- potential energy functions for different molecular systems, polar and non- polar molecules; Liquid phase models: Scatchard- Hildebrand theory, Lattice theory, two liquid theories, Flory- Huggins theory.
UNIT-III	**Heat Transfer and Mass transfer:** Conduction, convection, radiation; Modelling and design of heat transfer chemical process equipment; Mass transfer theories; Modelling and design of mass transfer equipment for distillation, absorption, leaching, liquid-liquid

	extraction, drying, humidification, dehumidification, and adsorption; Mass transfer in gas absorption with and without chemical reaction
UNIT-IV	**Chemical Reaction Engineering:** Kinetics of homogeneous reactions, Kinetics of solid catalyzed reactions: diffusion with reaction in porous catalyst, mechanism of catalytic reactions, development of rate equations, estimation of kinetic parameters, external/internal mass and heat transfer resistances in catalyst particles;Modelling and process design of multiphase reactors: hydrodynamics (pressure drop, hold- up and velocity profiles of phases involved), mixing studies (non-ideal flow behavior: RTD, estimation of dispersion/back-mixing), mass and heat transfer studies
UNIT-V	**Process Dynamics and Control:** Advance control systems: cascade, ratio, smith predictor, selective control, adaptive and inferential control systems and their application; Control systems with multiple loops: Design and control systems for multivariable processes, MIMO control systems, interaction and decoupling of control loops; Controls for nonlinear system; Discrete –time response of dynamic systems;Design of digital controllers.

Text Books/References:
1.	Luyben, W.L. Process Modeling, Simulation and Control for Chemical Engineers, McGraw-Hill
2.	Govier, G.W.; Aziz, K. The Flow of Complex Mixture in Pipes, Society of Petroleum Engineers
3.	Brenner, C. E. Fundamentals of Multiphase flows, Cambridge University Press
4.	Smith, J. M.; Van Ness, H. C.; Abbott, M. M. Introduction to Chemical Engineering Thermodynamics, McGraw Hill
5.	Bird, R.B.; Stewart,W.E.; Lightfoot, E.N. Transport Phenomena; John Wiley and Sons Publications
6.	Wetly,J.H; Wicks,C.E.;Wilson, R.E. Fundamentals of momentum, heat and Mass transfer, John Wiley and sons
7.	Hines, A.L.; Maddox, R.N. Mass Transfer Fundamentals and Applications, Prentice Hall
8.	King, C. J. Separation Processes, Tata McGraw Hill
9.	Froment, G.F.; Bischoff, K.B. Chemical Reactor Analysis and Design, John Wiley and Sons
10.	Smith J.M. Chemical Engineering Kinetics, McGraw-Hill
11.	Press W.H;Teukolsky S.A.; Vetterling, W.T.; Flannery, B.P. Numerical Recipes in Multi-

	Language Code, Cambridge University press
12.	Sharma, M. M.; Doraiswamy, L. K. Heterogeneous Reactions, John Wiley and Sons
13.	Levenspiel, O.;Kunni, D. Fluidization Engineering, John Wiley and Sons
14.	Davidson, J. F.; Harrison, D. Fluidization,Academic Press Inc.
15.	Stephanopoulos, G. Chemical Process Control :An Introduction to Theory and Practice, Prentice Hall
16.	Coughanowr, D.R.; Process Systems Analysis and Control, McGraw Hill
17.	Ewing, G.W. Instrumental Methods of Chemical analysis, Tata McGraw Hill