



قسم الهندسة الكيماوية - مواد الامتحان التنافسي للعام الدراسي 2025-2026

ماجستير

	MSc	Mark
	Subjects	
1.	Chemical Engineering Principles I and II	
2.	Fluid Flow	
3.	Mass Transfer	
4.	Heat Transfer	
5.	Thermodynamics	
6.	Reactor Design	
7.	Petroleum Refining	
8.	Unit Operation	
9.	Process Control	



Competitive Exam - Post-Graduate (MSc Program) 2025-2026		
Introduction to Chemical Engineering Mass Balance Basic Principles and Calculations in Chemical Engineering, 7th Edition - By David M. Himmelblau / James B. Riggs		
Chapter	Subject	Remarks
<u>One</u>	<u>Dimensions, Units, And Their Conversion</u> • Dimensional Consistency (Homogeneity)	
<u>Two</u>	<u>Moles, Density" And Concentration</u> • Analyses of Multicomponent Solutions and Mixtures	
<u>Six</u>	<u>Introduction To Material Balances</u> • Material Balances for Batch and Semi-Batch Processes-	
<u>Eight</u>	<u>Solving Material Balance Problems For Single Units Without Reaction</u>	
<u>Nine</u>	<u>The Chemical Reaction Equation and Stoichiometry</u> • Stoichiometry • Terminology for applications in stoichiometry	
<u>Ten</u>	<u>Material Balances For Processes Involving Reaction</u> • Species Material Balances • Material Balance Involving Combustion	
<u>Eleven</u>	<u>Material Balance Problems Involving Multiple Units</u> • Axial Dispersion • Chemical Reaction and Dispersion	
<u>Twelve</u>	<u>Recycle, bypass, Purge</u> • Recycle without chemical Reaction • Recycle with chemical Reaction • Bypass and purge	



Competitive Exam - Post-Graduate (MSc Program) 2025-2026

Fluid Flow

A textbook of fluid mechanics and hydraulic machines – by Er. R.K. Rajput

Chapter	Subject	Remarks
<u>One</u>	<u>Properties Of Fluids</u> - Newton's law of viscosity - Viscosity - Surface Tension and Capillarity	
<u>Two</u>	<u>Pressure Measurement</u> - Pressure Head of a Liquid - Absolute and Gauge Pressures - Manometers	
<u>Three</u>	<u>Fluid Kinematics</u> - Types of Fluid Flow - Rate of Flow or Discharge - Continuity Equation	
<u>Four</u>	<u>Fluid Dynamics - Bernoulli's Equation</u> - Practical Applications of Bernoulli's Equation - Venturimeter - Orificemeter - Rotameter and elbow meter 308	
<u>Five</u>	<u>Flow Through Orifices</u> - Classification of Orifices - Flow Through an Orifice - Hydraulic Co-efficients	



Competitive Exam - Post-Graduate (MSc Program) 2025-2026

Mass Transfer

Chemical Engineering V1 and V2- By RICHARDSON and HARKER

Chapter	Subject	Remarks
<u>One</u>	<u>Diffusion</u> - Stagnant diffusion, equimolecular counter diffusion, diffusion with reaction, diffusion coefficient in gases and in liquids. - Unsteady-state Diffusion, diffusion through variable cross-sectional area, mass transfer coefficient. - Mass transfer theories, overall gas-phase and overall liquid-phase mass transfer coefficients. - Gas and liquid-side resistances in interfacial mass transfer, Empirical correlations of mass transfer coefficient	
<u>Two</u>	<u>Absorption</u> - Introduction to absorption process, solubility of gases in liquids, selection of solvent for absorption, packed tower absorption. - Determine packed absorption height, minimum liquid flow rate. - Plate absorption tower - stripping process	
<u>Three</u>	<u>Leaching</u> - Introduction to solid-liquid extraction, batch leaching. - Continuous leaching for counter current constant and variable underflow. - Continuous leaching for co-current (cross current) - constant and variable underflow.	
<u>Four</u>	<u>Distillation</u> - Introduction, distillation, vapor, liquid equilibrium. - Batch distillation, Flash distillation. - Fractional distillation, the top and bottom operating line, the q line and energy balances,	

	• McCabe-Thiele graphical method, distillation operations economics. • Multi-component distillation. • Multi feeds and side streams distillation.	
<u>Five</u>	<u>liquid – liquid extraction</u> • Introduction to liquid – liquid extraction, Simple multi-stage contactors. • Counter-current contact. • Total and partial immiscibility, triangular diagrams and stage to stage graphical constructions.	
<u>Six</u>	<u>Evaporation</u> • Introduction to evaporation, heat transfer in evaporators. • Single and multiple-effect evaporators, rate of evaporation.	



Competitive Exam - Post-Graduate (MSc Program) 2025-2026		
Heat Transfer Heat Transfer- By J.P. Holman		
Chapter	Subject	Remarks
<u>One</u>	<u>Introduction</u> - Conduction heat transfer - Convection heat transfer - Radiation heat transfer	
<u>Two</u>	<u>Steady-State Conduction-One Dimension</u> - The plane wall - Radial system - The overall heat transfer coefficient - Critical thickness of insulation - Heat-source system - Cylinder with heat source - Fins - Thermal contact resistance	
<u>Four</u>	<u>Unsteady-State Conduction</u> - Lumped heat capacity system - Transient heat flow in a semi-infinite solid	
<u>Five</u>	<u>Principles of convection</u> - Laminar boundary layer on a flat plate - The thermal boundary layer - The relation between fluid friction and heat transfer	
<u>Ten</u>	<u>Heat Exchangers</u> The log mean temperature difference.	



Competitive Exam - Post-Graduate (MSc Program) 2025-2026

Thermodynamics

INTRODUCTION TO CHEMICAL ENGINEERING

THERMODYNAMICS By J. M. Smith; H. C. Van Ness; M. M. Abbott; M. T. Swihart

Chapter	Subject	Remarks
<u>One</u>	<u>Fundamental Concepts And Definitions</u> - isolated system - intensive and extensive properties - path and state functions - reversible and irreversible process - temperature - Zero law of thermodynamic	
<u>Two</u>	<u>The First Law And Other Basic Concepts</u> - First law of thermodynamics - internal energy - enthalpy - heat capacity	
<u>Three</u>	<u>P-V-T Behavior Of Pure Fluids - Ideal Gases And Ideal Gas Processes</u> - Isothermal - Adiabatic-isochoric-isobaric - Reversible and Irreversible process.	
<u>Five</u>	<u>The Second Law Of Thermodynamics</u> - second law of thermodynamics: entropy. - the third law of thermodynamics. - Heat engines. - Carnot cycle.	
<u>Six</u>	<u>Thermodynamic Properties Of Fluids</u> - Residual Properties - two Phase Systems	
<u>Seven</u>	<u>Applications Of Thermodynamics To Flow Processes</u> - Turbines - compression	
<u>Eight</u>	<u>Production Of Power From Heat</u> The Steam Power Plant	

<u>Nine</u>	<u>Refrigeration And Liquefaction</u> • The Carnot Refrigerator • The Vapor-Compression Cycle	
--------------------	--	--



Competitive Exam - Post-Graduate (MSc Program) 2025-2026

Reactor Design

Elements of Chemical Reaction Engineering, 5th edition, Pearson. - By H. Scott Fogler

Chapter	Subject	Remarks
<u>Two</u>	<u>Conversion And Reactor Sizing</u> • Definition of Conversion • CSTR • PFR • Reactors in Series	
<u>Three</u>	<u>Rate Law And Stoichiometry</u> • Flow systems • The Reaction Rate Constant • Batch Systems	
<u>Four</u>	<u>Isothermal Reactor Design</u> • Design of Continuous Stirred Tank Reactors • Design of Plug flow reactors (PFRs) • Membrane Reactors • Flow Through a Packed Bed and Pressure Drop	
<u>Five</u>	<u>Collection And Analysis Of Rate Data</u> • Batch Reactor Data • Method of Initial Rates • Method of Half-Lives • Differential Reactors	



Competitive Exam - Post-Graduate (MSc Program) 2025-2026

Petroleum Refining

1- Fahim, M.A.; Al-Shahhaf, T.A. and Elkilani, A.S., Fundamentals of Petroleum Refining, Elsevier. 2009

2- Hsu, Ch.s. and Robinson, P.R., Practical Advances in Petroleum Processing, Springer. 2007.

3- Riazi, M. R., Characterization and Properties of Petroleum Fractions, ASTM International.2015.

Chapter	Subject	Remarks
<u>One</u>	Classification of Crude Oils, Composition of Crude Oils	
<u>Two</u>	Physical and Chemical Properties of Crude oil and Oil Products	
<u>Three</u>	Evaluation of Crude Oils	
<u>Four</u>	Crude Oil Pre-treatment, Fractionation of Crude Oil (Atmospheric and Vacuum Distillation, Light End Fractionation, Process Description)	
<u>Five</u>	Thermal Cracking and Coking Processes	
<u>Six</u>	Catalytic Operations (Processes and calculations) - (Fluid Catalytic Cracking, Hydrocracking, Hydrotreating, Catalytic Reforming, Isomerization, Alkylation, Catalytic Dewaxing)	
<u>Seven</u>	Chemical Treatment of Oil Products	
<u>Eight</u>	Lubricating Oils (Specifications, Production Process, Calculations)	
<u>Nine</u>	Solvent Refining (Solvent Deasphalting, Solvent Extraction, Solvent Dewaxing)	
<u>Ten</u>	Oil Products – Properties and Specifications, Description of Process Flow and Calculations- (Oil Gases, Gasoline, Kerosene, Jet Fuel, Gas Oil, Diesel Oil, Fuel Oil, Asphalt, Greases and Wax). Oil Product Blending.	



Competitive Exam - Post-Graduate (MSc Program) 2025-2026

Unit Operations Coulson J.D. & Richardson J.F., Chemical Engineering, Vol. II, ELBS, Pergamon. 2002.

Chapter	Subject	Remarks
<u>Two</u>	<u>Particle Size Reduction And Enlargement</u>	
<u>Three</u>	<u>Motion Of Particles In A Fluid</u>	
<u>Four</u>	<u>Flow Of Fluids Through Granular Beds And Packed - Columns</u>	
<u>Five</u>	<u>Sedimentation</u>	
<u>Six</u>	<u>Fluidization</u>	
<u>Seven</u>	<u>Liquid Filtration</u>	
<u>Nine</u>	<u>Centrifugal Separations</u>	



Competitive Exam - Post-Graduate (MSc Program) 2025-2026		
Process Control		
Process Dynamics and Control By Seborg, Edgar, Mellichamp and Doyle		
Chapter	Subject	Remarks
<u>One</u>	<u>Introduction to Process Control</u> - Process Control Terminology - Control Systems Types (block and schematic diagrams) - Illustrative Examples	
<u>Two</u>	<u>Theoretical Models of Chemical Processes</u> - General Modelling Principles - Degrees of Freedom Analysis - Dynamic Models of Representative Processes	
<u>Three</u>	<u>Laplace Transforms</u> - Laplace Transforms of Representative Functions - Solution of Differential Equations by Laplace Transform Techniques - Partial Fraction Expansion - Final/Initial value theorems and time delay problem	
<u>Four</u>	<u>Transfer Function Models</u> - Introduction to Transfer Function Models - Properties of Transfer Functions - Linearization of Nonlinear Models	
<u>Five</u>	<u>Dynamic Behavior Of First-Order And Second-Order Processes</u> - Response of First-Order Processes - Response of Integrating Processes	
<u>Six</u>	<u>Dynamic Response Characteristics Of More Complicated Processes</u> - Processes with Time Delays - Approximation of Higher-Order Transfer Functions - Interacting and Noninteracting Processes	
<u>Eight</u>	<u>Feedback Controllers</u> - Basic Control Modes - Features of PID Controllers	

	• On–Off Controllers	
<u>Nine</u>	<u>Control System Instrumentation</u> • Sensors, Transmitters, and Transducers • Final Control Elements (Control Valves)	
<u>Eleven</u>	<u>Dynamic Behaviour And Stability Of Closed-Loop Control Systems</u> • Block Diagram Representation • Closed-Loop Transfer Functions • Closed-Loop Responses of Simple Control Systems	
<u>Twelve</u>	<u>Pid Controller Design/Tuning</u> • Model-Based Design Methods • Controller Tuning Relations	
<u>Fourteen</u>	<u>Frequency Response Analysis And Control System Design</u> • Sinusoidal Forcing of a First-Order Process • Sinusoidal Forcing of an nth-Order Process • Bode Diagrams and Bode Stability Criterio	Ch14 and Appendix J