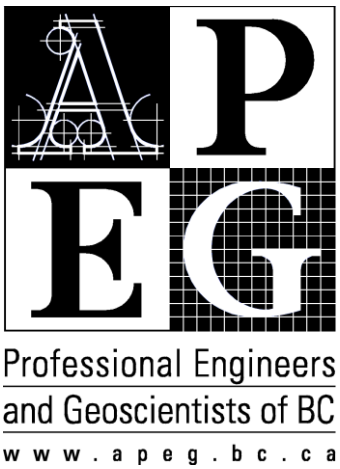

2004 CHEMICAL ENGINEERING SYLLABUS

and

Checklist for Self-Evaluation

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INTRODUCTION

Nineteen engineering disciplines are included in the Examination Syllabi issued by the Canadian Engineering Qualifications Board (CEQB) of the Canadian Council of Professional Engineers(CCPE).

Each discipline examination syllabus is divided into two examination categories, compulsory and elective. A full set of Chemical Engineering examinations consists of nine, three-hour examination papers. Candidates will be assigned examinations based on an assessment of their academic background. Examinations from discipline syllabi other than those specific to the candidate's discipline may be assigned at the discretion of the constituent Association/Ordre.

Before writing the discipline examinations, candidates must have passed, or have been exempted from, the Basic Studies Examinations.

The constituent Association/Ordre will supply information on examination scheduling, textbooks, materials provided or required, and whether the examinations are open or closed book.

NOTE TO CANDIDATES: THE LISTED TEXTBOOKS BELOW ARE ONLY SUGGESTED READING. THE LIST DOES NOT DEFINE OR LIMIT THE SYLLABUS.

The Association of
Professional Engineers and Geoscientists
of British Columbia

2004 CHEMICAL
ENGINEERING SYLLABUS
Checklist for Self-Evaluation

Candidate Name: _____ ID# _____

Exam Number and Name	Applicant's Self-Evaluation – Course Equivalent	For Office Use Only
Basic Studies (6 Required)		
04-BS-1 – Mathematics		
04-BS-2 – Probability & Statistics		
04-BS-7 – Mechanics of Fluids		
04-BS-10 – Thermodynamics		
04-BS-12 – Organic Chemistry		
04-BS-15 – Engineering Graphics & Design Process		
Basic Studies (2 Required)		
04-BS-3 – Statics and Dynamics		
04-BS-4 – Electric Circuits and Power		
04-BS-5 – Advanced Mathematics		
04-BS-6 – Mechanics of Materials		
04-BS-11 – Properties of Materials		
04-BS-13 – Biology		
04-BS-14 – Geology		
Group A (6 required)		
04-Chem-A1 – Process Balances and Chemical Thermodynamics		
04-Chem-A2 – Mechanical and Thermal Operations		
04-Chem-A3 – Mass Transfer Operations		
04-Chem-A4 – Chemical Reactor Engineering		
04-Chem-A5 – Chemical Plant Design and Economics		
04-Chem-A6 – Process Dynamics and Control		

Group B (3 Required)		
04-Chem-B1 – Transport Phenomena		
04-Chem-B2 – Environmental Engineering		
04-Chem-B3 – Simulation, Modelling and Optimization		
04-Chem-B4 – Biochemical Engineering		
04-Chem-B5 – Pulp and Paper Technology		
04-Chem-B6 – Petroleum Refining and Petrochemicals		
04-Chem-B7 – Extractive Metallurgy		
04-Chem-B8 – Polymer Engineering		
04-Chem-B9 – Advanced Materials		
04-Chem-B10 – Life Cycle Assessment (LCA)		
Complementary Studies(All Required)		
11-CS-1 Engineering Economics		
11-CS-2 Engineering in Society – Health and Safety		
11-CS-3 Sustainability, Engineering and the Environment		
11-CS-4 Engineering Management		

CHEMICAL ENGINEERING EXAMINATIONS

GROUP A

COMPULSORY EXAMINATIONS (SIX REQUIRED)

04-Chem-A1 Process Balances and Chemical Thermodynamics

The analysis of industrial and chemical processes; mass conservation and energy conservation; thermochemistry; properties of pure substances; properties of solutions; energy and the first law of thermodynamics; the second law of thermodynamics and entropy; applications of the laws of thermodynamics to problems in the behaviour of fluids, flow processes, power cycles, refrigeration and heat pumps, phase equilibria and chemical reaction equilibria.

Suggested Texts:

J.M. Smith, H.C. Van Ness, M.M. Abbott, Introduction to Chemical Engineering Thermodynamics, sixth edition. McGraw-Hill, 2001.

R.W. Felder, R.W. Rousseau, Elementary Principles of Chemical Processes, third edition. John Wiley, 2000.

04-Chem-A2 Mechanical and Thermal Operations

Fluid statics. Incompressible and compressible flow of fluids in piping. Sizing of pumps, metering. Flow through packed beds, fluidization, settling. Mixing and blending. Solids handling, screening, and filtration. Thermal operations such as evaporation and crystallization. Theory and practice of conductive, convective, and radiative heat transfer; design of heat exchangers; temperature measurement.

Suggested Texts:

C.J. Geankoplis, Transport Processes and Unit Operations, third edition. Prentice Hall, 1993.

W.L. McCabe, J.C. Smith, P. Harriott, Unit Operations of Chemical Engineering, sixth edition. McGraw-Hill, 2001.

F.P. Incropera, D.P. DeWitt, Fundamentals of Heat and Mass Transfer, fifth edition. John Wiley, 2001.

04-Chem-A3 Mass Transfer Operations

Application of equilibrium theory and rate considerations to theory and practice of absorption, adsorption, distillation, drying, liquid-liquid extraction, membrane separation. Mass transfer at the molecular level.

Suggested Texts:

R.E. Treybal, Mass Transfer Operations, third edition. McGraw-Hill, 1980.

P.H. Wankat, Equilibrium Staged Separations. Elsevier, 1988.

J.D. Seader, E.J. Henley, Separation Process Principles. John Wiley, 1998.

W.L. McCabe, J.C. Smith, P. Harriott, Unit Operations of Chemical Engineering, sixth edition. McGraw-Hill, 2001.

04-Chem-A4 Chemical Reactor Engineering

Application of the principles of chemical kinetics and other rate phenomena to the design of chemical reactors. Dynamics in chemical systems, including chemical kinetics, catalysis and transport processes. Theory of idealized isothermal reactors including batch, plug flow, and continuous stirred tank reactors for single and multiple reactions. Residence time distributions and their effect on conversion. Simple adiabatic and non-isothermal reactors with homogeneous and heterogeneous reactions; thermal run-away reactions.

Suggested Texts:

H.S. Fogler, Elements of Chemical Reaction Engineering, third edition. Prentice Hall, 2002.

04-Chem-A5 Chemical Plant Design and Economics

Structure of chemical process systems and systematic methods for capital and operating cost calculations. Economic factors in design, economic balances, capital and operating cost estimation techniques, assessment of alternative investments and replacements, and application of compound interest calculations. Simple optimization theory. Evaluation of process alternatives. Equipment and materials selection. Factors such as energy, safety, hygiene, and environmental protection. Familiarity with computer process simulation. Intrinsically safe design. Risk analysis.

Suggested Texts:

M.S. Peters, K.D. Timmerhaus, R.E. West, Plant Design and Economics for Chemical Engineers, fifth edition. McGraw-Hill, 2003.

W.D. Seider, J.D. Seader, D.R. Lewin, Process Design Principles: Synthesis, Analysis and Evaluation. John Wiley, 1999.

R. Turton, R.C. Bailie, W.B. Whiting, J.A. Shaeiweitz, Analysis, Synthesis, and Design of Chemical Processes, second edition, Prentice Hall, 2003.

04-Chem-A6 Process Dynamics and Control

Concept of transfer functions. Response of simple chemical processes to step, ramp, and sinusoidal inputs. Transient response of interacting elements in series. Frequency response analysis of simple systems. On-off control, cascade control, ratio control, proportional, integral, derivative, and combinations of these control actions, single-input/single-output control and multiple-input/multiple-output control. Closed-loop response. Feedback and feedforward control. Controller tuning and algorithms. Simple stability analysis. Dynamics and control of common chemical process units such as heat exchangers, simple reactors, and agitated vessels. Hardware implementation, analog and digital, of simple control algorithms and designs.

Suggested Texts:

D.E. Seborg, T.F. Edgar, D.A. Mellichamp, Process Dynamics and Control. John Wiley, second edition, 2003.

T. Marlin, Process Control, Designing Processes and Control Systems for Dynamic Performance,

second edition. McGraw-Hill, 2000.

B.W. Bequette, Process Control: Modeling, Design and Simulation. Prentice Hall, 2003.

C.A. Smith, A.B. Corripio, Principles and Practice of Antomatic Process Control, John Wiley, second edition, 1997.

GROUP B

ELECTIVE EXAMINATIONS (THREE REQUIRED)

04-Chem-B1 Transport Phenomena

The application of integral and differential techniques for solving problems involving mass, energy and/or momentum transport through solids and within fluids. Steady and unsteady state processes. Molecular transport. Convective transfer of heat and mass involving laminar and turbulent fluid flows.

Suggested Texts:

R.S. Brodkey, H.C. Hershey, Transport Phenomena: A Unified Approach. McGraw-Hill, 1988.

R.B. Bird, W.E. Stewart, E.N. Lightfoot, Transport Phenomena. Second edition, John Wiley, 2002.

04-Chem-B2 Environmental Engineering

Engineering aspects of air and water pollution abatement and effluent treatment. Characterization of water contaminants and their measurement, biological oxygen demand, sedimentation, flotation, aeration, and activated sludge processes, pH control, ion exchange, oxidation-reduction, electrodialysis, reverse osmosis. Sources and dispersion of atmospheric pollutants. Control methods for particulates, gases, and vapours. Photochemical reactions, noxious pollutants, and odour control. Contaminated soil remediation. Measurement techniques.

Suggested Text:

G. Kiely, Environmental Engineering. McGraw-Hill Ryerson, 1996.

04-Chem-B3 Simulation, Modelling, and Optimization

The analysis and modelling of chemical processes using either a mechanistic or an empirical input/output approach. Subsystem modelling to reduce complex processes to simpler component parts. Linearization of non-linear processes. Optimization methods; direct search, climbing and elimination techniques, linear and non-linear programming.

Suggested Texts:

S.M. Walas, Modelling with Differential Equations in Chemical Engineering. Butterworth-Heinemann, 1991.

D. Basmadjian, The Art of Modeling in Science and Engineering. Chapman & Hall, 1999.

B.W. Beqette, Process Dynamics: Modeling, Analysis and Simulation. Prentice Hall, 1998 (first 12 chapters and all modules).

P. Venkataraman, Applied Optimization with Matlab Programming. John Wiley, 2002.

T.F. Edgar, D.M. Himmelblau, L.S. Lasdon, Optimization of Chemical Processes. Second edition. McGraw-Hill, 2001.

04-Chem-B4 Biochemical Engineering

Basic microbiology and chemistry of cells, biochemical kinetics, enzymes, metabolic pathways, energetics, transport phenomena and reactor design as applied to biochemical reactors, scale-up, fermentation technology.

Suggested Text:

J.E. Bailey, D.F. Ollis, Biochemical Engineering Fundamentals, second edition. McGraw-Hill, 1986.

04-Chem-B5 Pulp and Paper Technology

Papermaking raw materials: wood anatomy and chemistry. Pulping processes: mechanical pulping, chemi-thermo-mechanical processes, chemical pulping (sulphite, Kraft). Pulp treatment: refining and bleaching. Papermaking equipment and processes. Environmental protection. Structure and properties of paper and paperboard.

Suggested Texts:

J.P. Casey, Pulp and Paper: Chemistry and Chemical Technology, third edition, Volumes 1 and 2. Wiley Interscience, 1980.

G.A. Smook, Handbook for Pulp and Paper Technologists, third edition, Angus Wilde Publ, Inc., 2002

04-Chem-B6 Petroleum Refining and Petrochemicals

The composition and classification of petroleum. Crude oil evaluation in relation to product quality. Refinery products: properties, specifications, and testing. The petroleum refinery: crude oil distillation, catalytic cracking, alkylation, hydrogen production, catalytic reforming, hydrotreating, amine processes, sulphur production, isomerization, polymerization, oxygen compounds. Lubricating oil and asphalt manufacturing. Synthesis of primary products; ethylene, methanol, glycols, aromatics.

Suggested Texts:

J.H. Gary, G.E. Handwerk, Petroleum Refining, Technology and Economics, fourth edition. Marcel Dekker, 2001.

J.G. Speight, The Chemistry and Technology of Petroleum, third edition. Marcel Dekker, 1999.

04-Chem-B7 Extractive Metallurgy

Thermodynamics and reaction kinetics of extractive metallurgical processes. Electrolytic reduction of molten salts. Metal refining processes. Heat transfer, mass transfer, and materials preparation in the metallurgical industry. Comparison of processes. Equipment selection and operation.

Suggested Texts:

T. Rosenqvist, Principles of Extractive Metallurgy, second edition. McGraw-Hill, 1983.

C. Bodsworth, The Extraction and Refining of Metals. CRC Press, 1994.

04-Chem-B8 Polymer Engineering

Basic polymer structures and characterization of polymer physical, chemical, and mechanical properties. Polymerization reactions and kinetics; chain formation and co-polymerization. Polymerization processes: bulk, suspension, solution, and emulsion polymerizations. Polymer flow behaviour describing non-Newtonian and visco-elastic effects. Polymer processing including extrusion, moulding and film production. Polymer systems: additives, blends, composites, and fibre reinforcement.

Suggested Texts:

A. Rudin, The Elements of Polymer Science and Engineering, second edition. Academic Press, 1998.

J. Fried, Introduction to Polymer Science and Technology. Prentice Hall, 1995

04-Chem-B9 Advanced Materials

Properties, production of and uses of composites, engineered plastics, biopolymers, special coatings, and nanostuctured materials with emphasis on structure property relationships.

04-Chem-B10 Life Cycle Assessment (LCA)

Concepts of LCA. Applications to energy utilization, environment, sustainable development and process analysis and optimisation.