

## BASIC STUDIES EXAMINATIONS

### INTRODUCTION

The Basic Studies Examinations have been structured to ensure that applicants have an adequate foundation in advanced mathematics, basic sciences, and engineering sciences. A full set of Basic Studies Examinations consists of six, three-hour examination papers. Candidates will be assigned examinations based on an assessment of their academic background. Prior to assignment of basic studies examinations, candidates are required to have met PEO's minimum academic requirements for licensure.

The level expected in these examinations is that of textbooks currently used in first and second year courses in programs accredited by the Canadian Engineering Accreditation Board (CEAB) of the Canadian Council of Professional Engineers. Information on examination scheduling, textbooks, materials provided or required, and whether the examinations are open or closed book will be supplied by PEO's Examination Centre.

### 04-BS-1 - Mathematics

Calculus, Vector, and Linear Algebra: Applications involving matrix algebra, determinants, eigenvalues; first and second order linear ordinary differential equations, Laplace transforms. Vector algebra; vector functions and operations; orthogonal curvilinear coordinates; applications of partial derivatives, Lagrange multipliers, multiple integrals, line and surface integrals; integral theorems (Gauss, Green, Stokes). Power series.

*Suggested Texts:*

Erwin Kreyszig, Kreyszig: Advanced Engineering Mathematics, latest edition. John Wiley. ISBN 0-471-15496-2.

### 04-BS-2 - Probability and Statistics

Concepts of probability, events and populations, probability theorems, concept of a random variable, continuous and discrete random variables, probability distributions, distributions of functions of a random variable, sampling and statistical estimation theory, hypothesis testing, simple regression analysis.

*Suggested Text:*

R.E. Walpole, R.H. Myers and S.L. Meyers, Probability and Statistics for Engineers and Scientists, latest edition. Prentice-Hall, 1998.

### **04-BS-3 - Statics and Dynamics**

Force vectors in two- and three-dimensions, equilibrium of a particle in two- and three-dimensions; moments and couples; equilibrium of rigid bodies in two- and three-dimensions; centroids, centres of gravity; second moment of area, moment of inertia; truss, frame and cable static analysis; friction. Planar kinematics of particles and rigid bodies; planar kinetics of particles and rigid bodies; work and energy, impulse, and momentum of particles and rigid bodies.

#### *Suggested Texts:*

R.C. Hibbeler, Engineering Mechanics: Statics and Dynamics, tenth edition. Prentice-Hall, 2004.

Sheppard, Sheri D. and Benson H. Tongue, Statics: Analysis and Design of Systems in Equilibrium. Wiley, 2005.

Sheppard, Sheri D. and Benson H. Tongue, Dynamics: Analysis and Design of Systems in Motion. Wiley, 2005.

### **04-BS-4 - Electric Circuits and Power**

Basic laws, current, voltage, power; DC circuits, network theorems, network analysis; simple transients, AC circuits. Impedance concept, resonance; use and application of phasors and complex algebra in steady-state response; simple magnetic circuits; basic concepts and performance characteristics of transformers; an introduction to diodes and transistors; rectification and filtering; simple logic circuits.

#### *Suggested Text:*

J.W. Nilsson and S.A. Riedel, Electric Circuits, fifth edition. Addison-Wesley, 1996.

### **04-BS-5 - Advanced Mathematics**

Series Solutions of Differential Equations: Series solutions of ordinary differential equations, boundary value problems and orthogonal functions, Fourier series.

Numerical Methods: Use of computers for numerical solution of engineering problems, including techniques involving library subroutines and spreadsheets. Approximations and errors, interpolation, systems of linear and non-linear algebraic equations, curve fitting, numerical integration and differentiation, and ordinary differential equations.

#### *Suggested Texts:*

Erwin Kreyszig, Kreyszig: Advanced Engineering Mathematics, latest edition. John Wiley. ISBN 0-471-15496-2

R. Burden and J. Faires, Numerical Analysis, latest edition.

#### **04-BS-6 - Mechanics of Materials**

Definitions of normal stress, shearing stress, normal strain, shearing strain; shear force and bending moment diagrams; members subjected to axial loading; members subjected to torsional loading; compound stresses, Mohr's circle; deformation of flexural and torsional members; failure theories; elastic and inelastic strength criteria; columns.

*Suggested Text:*

R.C. Hibbeler, Mechanics of Materials, third edition. Prentice-Hall, 1997.

#### **04-BS-7 - Mechanics of Fluids**

Fluid characteristics, dimensions and units, flow properties, and fluid properties; the fundamentals of fluid statics, engineering applications of fluid statics; the one-dimensional equations of continuity, momentum, and energy; laminar and turbulent flow, flow separation, drag and lift on immersed objects; wall friction and minor losses in closed conduit flow; flow of incompressible and compressible fluids in pipes; dimensional analysis and similitude; flow measurement methods.

*Suggested Text:*

J.A. Robertson and C.T. Crowe, Engineering Fluid Mechanics, sixth edition. John Wiley, 1997.

#### **04-BS-8 - Digital Logic Circuits**

Boolean algebra, encoders, decoders, shift registers, and asynchronous and synchronous counters together with timing considerations. Design of asynchronous circuits, synchronous sequential circuits, and finite state machines. Karnaugh mapping techniques, and state tables and diagrams. Introduction to programmable logic.

*Suggested Text:*

M.M. Mano, Digital Design, second edition. Prentice-Hall, 1991

#### **04-BS-9 - Basic Electromagnetics**

Introduction to the basic electromagnetic principles upon which electrical engineering is based (laws in both integral and differential form). Classical development of electrostatics and magnetostatics leading to Maxwell's equations. Application of electromagnetic theory to calculation of d-c circuit parameters, study of plane wave transmission in various media.

*Suggested Text:*

D.K.Cheng, Electromagnetic Fields and Waves, second edition. Addison-Wesley, 1992.

#### **04-BS-10 - Thermodynamics**

Thermodynamic states of simple systems; the laws of thermodynamics; equilibrium, PVT and other thermodynamic diagrams; equation of state; compressibility charts and steam tables; calculation of property changes; enthalpy; applications of thermodynamics, cycles, reversibility; thermodynamics of phase changes, Gibbs phase rule, gas-vapour mixtures.

*Suggested Text:*

Y.A. Cengel and M.A. Boles, Thermodynamics: An Engineering Approach, third edition. WCB McGraw-Hill, 1998.

#### **04-BS-11 - Properties of Materials**

Properties of materials for mechanical, thermal and electrical applications. Atomic bonding, solid solutions, crystallisation. Equilibrium phase diagrams, applications to steel and aluminium alloys, heat treatments. Structure and special properties of polymers and ceramic materials. General characteristics of metallic composites, polymeric composites and concrete. Introduction to materials in hostile environments: corrosion, creep at high temperature, refractory materials, subnormal temperature brittle fracture.

*Suggested Text:*

Callister, William D., Jr. Materials Science and Engineering: An Introduction, 5<sup>th</sup> edition. Wiley College. 0-471-32013-7.

#### **04-BS-12 - Organic Chemistry**

Principles of organic chemistry developed around the concepts of structure and functional groups. The main classes of organic compounds. Properties of pure substances. Introduction to molecular structure, bond types, properties, synthesis and reactions, reaction mechanisms, as a means of systematizing organic reactions.

*Suggested Texts:*

J. McMurry, Organic Chemistry, fourth edition. Brooks/Cole.  
R.T. Morrison, R. N. Boyd, Organic Chemistry, seventh edition. Prentice-Hall, 1999.

#### **04-BS-13 - Biology**

Cellular reproduction, growth, and differentiation; metabolism and bioenergetics of living cells; cell structure and function related to the material properties of plant and animal tissues; introductory microbiology — characteristics and classification of microorganisms; interactions of microorganisms with man in the natural world; kinetics and mathematical models of microbial growth; engineered biological systems such as bio-reactors, bio-instrumentation, and waste treatment systems.

##### *Suggested Texts:*

James E. Bailey and David F. Ollis, Biochemical Engineering Fundamentals, 2<sup>nd</sup> edition. McGraw-Hill Book Company, 1986. ISBN# 0-07-003212-2.

or

Harvey W. Blanch and Douglas S. Clark, Biochemical Engineering. Marcel Dekker Inc., 1997. ISBN# 0-8247-0099-6

And

N.N. Mohsenin, Physical Properties of Plant and Animal Materials. Gordon and Breach Science Publishers, 1986. ISBN# 0-677-21370-0.

#### **04-BS-14 - Geology**

The structure of the earth, plate tectonics, earthquakes and igneous activity. Minerals and rocks including their formation, identification, basic properties, and classification. Processes of weathering, erosion, transport, and deposition of geological materials and their results of significance to engineering. Occurrence, flow, and quality of groundwater. Introductory aspects of structural geology including faulting, folding, and the overall formation of discontinuities and their effect on the engineering properties of rock masses. Aerial photography and geological maps.

##### *Suggested Texts:*

Lutgens and Tarbuck, Essentials of Geology, 6<sup>th</sup> edition. Prentice Hall, 1997. ISBN 0-13-752510-9. Zumberge and Rutherford, Laboratory Manual for Physical Geology, 9<sup>th</sup> edition. McGraw Hill.

#### **04-BS-15 - Engineering Graphics and Design Process**

Engineering drawing: Orthographic sketching. Standard orthographic projection. Principal views, selection and positioning of views. Visualization. Conventions and practices. First and second auxiliary views. Basic descriptive geometry. Section views, types, hatching conventions. Basic dimensioning requirements. Tolerance for fits and geometry control. Detail drawings and assembly drawings, other drawings and documents used in an engineering organization. Bill of materials. Fasteners and welds. Design process and methods. Project management & teamwork. Requirements and function analysis in design. Conceptual design and testing. Concept evaluation design factors such as: cost, quality, manufacturability, safety, etc. Systems modelling & design detail.

##### *Suggested Text:*

Earle, James H., Engineering Design Graphics, 11<sup>th</sup> edition. Prentice Hall, 2004. ISBN: 0-13-142573-0

Bertoline, G., Fundamentals of Graphic Communication, 4<sup>th</sup> edition. McGraw Hill, 2005. ISBN: 0072864583

#### **04-BS-16 - Discrete Mathematics**

Logic: propositional equivalences, predicates and quantifiers, sets, set operations, functions, sequences and summations, the growth of functions. Algorithms: complexity of algorithms, the integers and division, matrices. Methods of proof: mathematical induction, recursive definition. Basics of counting: pigeonhole principle, permutations and combinations, discrete probability. Recurrence relations: inclusion-exclusion. Relations and their properties: representing relations, equivalence relations. Introduction to graphs: graph terminology, representing graphs and graph isomorphism, connectivity, Euler and Hamilton paths. Introduction to sorting.

##### *Suggested Texts:*

Epp, Susanna, Discrete Mathematics with Applications, Third Edition, Thomson Learning, 2004 ISBN 0-534-35945-0

or

Rosen, Kenneth, Discrete Mathematics and its Applications, Sixth Edition, McGraw-Hill, 2007 ISBN 0-07-288008-2.