GEOLOGY
SYLLABUS OF EXAMINATIONS
2000 Edition

1. PREAMBLE

The geological knowledge required by APEGGA for registration as a Professional Geologist (P. Geol.) closely matches the minimum qualifications recommended by the Canadian Council of Professional Geoscientists in either Geology or Environmental Geoscience. Information about the CCPG recommendations is provided at the CCPG's web site (www.ccpg.ca).

Minimum Required Knowledge

Examinations offered by APEGGA do not cover all possible knowledge subjects that qualify. The Syllabus of Geology Examinations is a selection that allow applicants to demonstrate knowledge requirements to the satisfaction of the Board of Examiners.

The fundamental unit of knowledge in the outline below is the educational unit (EU). One educational unit in a subject is defined as formal instruction equivalent to a one-term (one semester) course in an honors B.Sc. degree program at a Canadian university. For example, one EU could consist of approximately 3 hours of lecture or equivalent per week, with or without a lab, for thirteen weeks. An EU can be considered as the equivalent of one 3-credit hour course in a 120 credit-hour, 4-year degree program.

SECTION I: FUNDAMENTAL SCIENCE
(9 EUs required)

A. SPECIFIED SCIENCE
(6 EUs required)

- Mathematics - Minimum 1 EU
- Physics - Minimum 1 EU
- Chemistry - Minimum 1 EU

AND
3 additional EUs from Mathematics, Physics, Chemistry, or Biology, with maximum credit of ***2 EUs*** in Biology in sections A and B combined.

B. ADDITIONAL SCIENCE
(3 EUs required)

- Mathematics
- Physics
- Statistics
- Chemistry
- Biology
- Computer science

AND
Section II applies.
OR
Section III applies

SECTION II: GEOLOGY as outlined by CCPG
(20 EUs required in addition to Fundamental Science in Section I)

A. FIELD PRACTICE OR FIELD TECHNIQUES*
(1 EU required)

*Knowledge from field-based instruction, not lectures

B. FUNDAMENTAL SUBJECTS
(5 EUs required, with not more than one EU credited in one subject)

- Mineralogy
- Stratigraphy or sedimentology
- Petrology
- Structural geology
- Geochemistry
- Geophysics

C. ADDITIONAL SUBJECTS
(14 EUs required, of which at least 12 must be in Geoscience*)

Fourteen additional EUs are required which can be all in geoscience, with not fewer than twelve EUs in geoscience and not more than two EUs in science other than geoscience.

Definition of Geoscience: the constituent associations of the CCPG regulate the practice of professional geoscience as defined in the applicable Acts. They do not regulate activity in fields such as Earth system science, atmospheric science, meteorology, or oceanography. Those areas presently fall outside the scope of regulated professional geoscience in Canadian jurisdictions. However, for the purpose of credit in section C, up to two EUs in these or other sciences can be credited as science other than geoscience.

SECTION III: **ENVIRONMENTAL GEOSCIENCE as outlined by CCPG**

(20 EUs required in addition to Fundamental Science in Section I)

A. FIELD PRACTICE OR FIELD TECHNIQUES*
(1 EU required)

*Knowledge from field-based instruction, not lectures

B. FUNDAMENTAL SUBJECTS
(5 EUs required, with not more than one EU credited in one subject)

- Mineralogy
- Stratigraphy or sedimentology
- Geomorphology
- Quaternary geology
- Hydrology or hydrogeology
- Geochemistry

C. ADDITIONAL SUBJECTS
(14 EUs required, of which at least 12 must be in Geoscience*)

Fourteen additional EUs are required which can be all in geoscience, with not fewer than twelve EUs in geoscience and not more than two EUs in science other than geoscience.

****Definition of Geoscience:*** see Section II above.

An example of an Examiner check sheet for the assessment of an applicant's academic qualifications is given in the attached Appendix.

2. APEGGA SYLLABUS OF EXAMINATIONS

A. EXAMINATIONS IN FUNDAMENTAL SCIENCE
(Applicable to Section I of Outline)

2000-GFund-1a Elementary Calculus I
2000-GFund-1b Elementary Calculus II

I: Review of analytical geometry. Differentiation and integration of simple functions. Applications.

II: Differentiation and integration of trigonometric, exponential and logarithmic functions. Indeterminate forms and improper integrals. Applications.

Prime Text
Calculus. Stewart, J. (2nd edition) Brooks/Cole Publishing, 1991.

Supplementary Text
Theory and Problems of Differential and Integral Calculus. Ayres Jr., F. (3rd edition) McGraw-Hill Book Co., 1990. (Chapters 1 to 58, 61, 62). Schaum Outline Series
ISBN 0070026629

2000-GFund-2a General Physics I
2000-GFund-2b General Physics II

I: Vectors, forces in equilibrium, linear and rotational motion, dynamics of particles, oscillations.

II: Fluids, kinetic theory, heat and thermodynamics, electric charge, electric field, electric potential, electric currents, DC circuits.

Prime Text
Physics for Scientists and Engineers Serway, R.A. (3rd edition) Saunders College Publishing, 1992. ISBN 0-03-096026-6.

or
University Physics. Sears, F.W., (7th edition) Addison-Wesley 1987. ISBN 0201066815

2000-GFund-3a General Chemistry I
2000-GFund-3b General Chemistry II

I: Basic chemical concepts. Stoichiometry. Gas laws. Periodic table and the chemistry of selected elements. Atomic and molecular structure. Chemical bonding. Structures of organic compounds. States of matter and phase changes. Properties of solutions.

II: Acid/base concepts. Chemical kinetics and equilibrium. Acid-base and solubility equilibria. Elementary thermodynamics. Oxidation and reduction, electrochemistry.

Prime Text
Chemistry for Science and Engineering. Breck, Brown and McCowan (2nd edition) McGraw-Hill-Ryerson, 1989. ISBN 0075489759

Chemistry. McMurry, John and Fay, Robert C. (2nd edition). Prentice Hall Inc., Englewood Cliffs, New Jersey, 1997.

or
General Chemistry. Petrucci, R.H. and Harwood, W.S. (7th edition). Prentice Hall, 1997.

2000-GFund-4 Differential Equations and Transform Methods

Linear ordinary differential equations; the Laplace transformation; series solutions of differential equations; boundary value problems and orthogonal functions; Fourier series; Fourier integrals.

Prime Text
Linear Algebra with Applications. Nicholson, W.K. (3rd edition) P.W.S.K.E. Publishing Co., 1994. ISBN 0534936660

Supplementary Text
Boundary Value Problems. Powers, D.L. (3rd edition) Harcourt Brace Jovanovich, 1987. ISBN 0155055356

Mathematics of Physics and Modern Engineering. Sokolnikoff, I.S. and Redheffer, R.M. (2nd edition) McGraw-Hill, 1966. ISBN 0070596255

2000-GFund-5 Linear Algebra and Vector Analysis

Linear transformations; matrices and matrix operations; determinants; simultaneous linear algebraic equations; eigenvalues and eigenvectors. Vector algebra; vector functions and operators; orthogonal curvilinear multiple coordinates; applications of partial derivatives, multiple integrals, line and surface integrals; integral theorems.

Prime Text
Linear Algebra with Applications. Nicholson, W.K. (3rd edition) P.W.S.K.E. Publishing Co., 1994. ISBN 0534936660

Calculus with Analytic Geometry. Swokowski, E.W. (4th edition) Prindle, Weber & Schmidt, 1988. ISBN 0871500078

Supplementary Text

Vector Analysis. Spiegel, M.R. McGraw-Hill. Schaum Outline Series, 01/59. ISBN 007060228X

Linear Algebra. Lipschutz, S. McGraw-Hill. Schaum Outline Series, 1988. ISBN 0070990123

2000-GFund-6 Computing Science

Candidates must develop familiarity with a high level programming language (one of Fortran, Pascal, or C) and develop facility in writing computer programs.

Organization of stored program computers; principles of structured programming (input/output, assignment, selection and repetition, modular design using functions and procedures/subroutines, data structures including arrays and text files; design and testing of algorithms; introduction to numerical methods) curve fitting, numerical integration, root finding.

Prime Text
The candidate should select one of the following three texts according to his or her choice of programming language:

Fortran with Engineering Applications (5th edition). Koffman, E.B. and Friedman, F.L., Addison-Wesley, 1993. Chapters 1-8 and 12 cover examination material. ISBN 0201558750

Turbo Pascal (4th edition). Savitch, W.J., Benjamin/Cummings, 1993. Chapters 1-10 and 12 cover examination material. ISBN 0805304185

Practical C Programming (2nd edition). Oualline, S. O'Reilly & Associates, 1993. Chapters 1-9, 12, 13 and 15 cover examination material. ISBN 0156592035X

Regardless of his or her choice of programming language, the candidate should use the following text as a reference on numerical methods:

Numerical Mathematics and Computing (3rd edition). Cheney W. and Kincaid, D., Brooks/Cole, 1994. Chapters 1-5 cover examination material. ISBN 0534201121

2000-GFund-7 Thermodynamics

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

Prime Text
Fundamentals of Classical Thermodynamics. Van Wylen, G.J. and Sonntag, R.E. (SI Version, 4th edition) John Wiley and Sons Inc., 1993. ISBN 0471593958

Supplementary Text
Fundamentals of Engineering Thermodynamics. Howell, J.R. and Buckius, R.O. (SI Version, 2nd edition) McGraw-Hill, 1992. ISBN 0079093698

2000-GFund-8 Biology

The subject matter covers the four principal areas of biology, i.e., (1) unity, (2) diversity, (3) continuity and (4) interaction. Unity encompasses the historical events leading to major biological concepts, the chemistry of cells, cell structure and hereditary mechanisms. Diversity deals with the variety of cell types, organ systems and organisms from developmental and evolutionary points of view. Continuity covers the mechanisms of heredity as they relate to evolution. Darwinian evolution and the evolution of man are emphasized. Interaction places the emphasis on the ecosystem and the interaction of organisms with their environment.

Prime Text
Biology. Campbell, Neil A. (3rd edition) Benjamin/Cummins Company, Inc., Don Mills, Ontario 1993. Chapters 1, 6, 7, 10, 12, 15 16, 20, 21, 22, 23, 24, 27, 29, 30, 46, 49. ISBN 0805318801

2000-GFund-9 Physical Chemistry

Fundamental concepts of matter in relation to energy. The laws of classical thermodynamics and their application to the properties of gases, liquids, solids and solution. Transport phenomena. The basic laws of chemical kinetics, and their application to reactions in gaseous and liquid phases. Catalysis.

Prime Text
Physical Chemistry. Atkins, P.W. (5th edition) W.H. Freeman & Co., 1994. ISBN 0716724022

Supplementary Text
Physical Chemistry. Castellan, G.W. (3rd edition) Addison Wesley, 1983. ISBN 0201103869

Physical Chemistry. Alberty, R.A. and Sibley, R.J. (8th edition) Wiley, 1992. ISBN 0471621811

Physical Chemistry. Mortimer, R.G. Benjamin/Cummings Publishing Co., Inc., 1993. Hardcover ISBN 0805345604, paperback ISBN 0805346503

2000-GFund-10 Organic Chemistry

A study of compounds of carbon with emphasis on reaction mechanisms to illustrate the basic principles of organic chemistry. Structure and bonding, physical properties, and stereochemistry; addition, elimination, and displacement reactions by function group classification; structure-reactivity relationships; aromaticity and aromatic substitution; condensation reactions; spectroscopic methods for structure determination.

Prime Text
Organic Chemistry. Loudon, (3rd edition) McGraw Hill, 1995. ISBN 0805366504

Alternate Text
Organic Chemistry Study Guide. Loudon, (2nd edition) McGraw Hill, 1987.

Organic Chemistry. Loudon, (2nd edition) Addison Wesley, 1988.

Advanced Organic Chemistry. Carey, (3rd edition) Plenum, 1990. Paper,
Part A ISBN 0306434474, Part B ISBN 0306434571

2000-GFund-11 Inorganic Chemistry

The structure of many-election atoms, bonding and stereochemistry in inorganic compounds, elementary crystallography, solid-state science and aspects of inorganic solution chemistry. The chemistry of metals and ligand field theory; coordination compounds, metal carbonyls and organo-metallic compounds of the transition elements; descriptive chemistry of the first-row transition elements; industrial extraction of metals; uses of transition metal complexes as catalysts; an introduction to the role of metals in biology.

Prime Text
Inorganic Chemistry. Huhey (4th edition) Harper & Row, 1993. ISBN 006042995

Alternate Text
Inorganic Chemistry. Shriver, D., (2nd edition) Freeman Publications, 1995. ISBN 019855396X

2000-GFund-12 Statistics

Random variables and frequency distributions. Averages and variance. The binomial and normal distribution. Sampling distributions and elementary inference. X^2-test for contingency tables. Regression and correlation. Analysis of variance.

Prime Text
Introductory Statistics. Devore, (2nd edition) West Publishing, 1994. ISBN 0314027661

B. EXAMINATIONS IN FUNDAMENTAL GEOSCIENCE SUBJECTS
(Applicable to Sections II and III)

2000-Glgy-1 Mineralogy & Crystallography

Morphological crystallography, crystal systems, crystal symmetry including planes, rotation and inversion axes, crystal classes, Miller indices, axial ratios and stereographic projection. Theoretical principles of mineralogy. Determinative and descriptive mineralogy.

Prime Text
Manual of Mineralogy. Klein, C. and Hurlbut Jr., C.S. (21st edition) John Wiley and Sons, 1993. ISBN 047157452X

Introduction to Optical Mineralogy. Nesse, W.O. (2nd edition) Oxford University Press, 1991. ISBN 0195060245

Supplementary Text
Crystallography. Whittaker, E.J., Pergamon Press, 1981. ISBN 0080238041

Principles of Mineralogy. Blackburn, W.H. and Dennen, W.H. (2nd edition) Brown Publishing, Dubuque, IA, 1994. ISBN 069715078X

2000-Glgy-2 Principles of Stratigraphy and Sedimentation

Sedimentary processes, environments and facies; properties and classification of sedimentary rocks; code of stratigraphic nomenclature and the stratigraphic column; stratigraphic relationship and interpretations.

Prime Text
Principles of Sedimentology & Stratigraphy. Boggs, S. (2nd edition) Merrill Publishing Co., Toronto, 1995. ISBN 0023117923

Supplementary Text
Interpreting the Stratigraphic Record. Prothero, D.R. W.H. Freeman & Co., 1990. ISBN 0716718545

Stratigraphy and Sedimentation. Krumbein, W.C. and Sloss, L.L. (2nd edition) W.H. Freeman & Co., 1963. ISBN 0716702193

Facies Models. Walker, R.G. (editor) (3rd edition) Geoscience Canada Reprint Series 1, Geological Association of Canada, 1992. ISBN 0919216498

2000-Glgy-3 Igneous Petrology

Mineralogical and chemical classification of igneous rocks. Physics and chemistry of igneous rock formation.

Prime Text
Igneous Petrology. McBirney, A.R. (2nd edition) Jones and Bartlett, Boston MA. 1993. ISBN 0-86720-175-4

Alternative Text
Igneous Petrology. Hall, A. (2nd edition) Longman Group Ltd., Essex, England. 1996. ISBN 0-582-23080-2.

2000-Glgy-4 Sedimentary Petrology

Processes of clastic and chemical sedimentation, and diagenesis; sedimentary environments and facies; laboratory techniques in the study of sedimentary rocks.

Prime Text
Sedimentary Petrology: An Introduction of Sedimentary Rocks. Tucker, M. (2nd edition) Blackwell Scientific, Oxford, 1991. ISBN 0632029016

Supplementary Text
Sedimentary Petrology. Blatt, H. (2nd edition) Freeman, 1992. ISBN 0716722739

2000-Glgy-5 Metamorphic Petrology

Mineralogy and textures of metamorphic rocks. Concepts of metamorphic facies and facies series, and their pressure-temperature-composition interpretation.

Prime Text
An Introduction to Metamorphic Petrology. Yardley, B.W. Longman Scientific & Technical, England, 1989. ISBN 0470211962

Alternative Text
Principles of Igneous & Metamorphic Petrology. Philpotts, A.R. Prentice-Hall, 1990. ISBN 013691361X

Supplementary Text
Metamorphic Petrology - Mineralogical, Field and Tectonic Aspects. Turner, F.J. (2nd edition) McGraw Hill, 1981. ISBN 089116510X

2000-Glgy-6 Structural Geology

Orientation, measurement, representation and geometric analysis of planar and linear geologic structures. Description and geometric analysis of faults and folds; relation of faults to stress. Geologic maps, subsurface maps, structure contour maps and cross sections. Descriptive geometry, stereographic and equal area projections. Mechanical principles; stress, strain and deformation in rocks. Analysis of joints, secondary foliations and lineations.

Prime Text
Structural Geology of Rocks and Regions. Davis, G.H. (2nd edition) Wiley, 1995.
ISBN 0471526215

Supplementary Text
Basic Methods of Structural Geology. Marshak, S. and Mitra, G. Prentice Hall, 1988.
ISBN 0130651788

Principles of Structural Geology. Suppe, J. Prentice Hall, 1985. ISBN 0137105002

Foundations of Structural Geology. Park, R.G. (2nd edition) Blackie Press, 1989. ISBN 0412019418

2000-Glgy-7 Geochemistry

Chemical processes taking place in geologic settings with emphasis on the abundance relationships of the elements in the Earth's crust and the laws governing the migration and distribution of elements of the Earth; the application of geochemistry in the search for mineral deposits.

Prime Text
Principles and Applications of Inorganic Geochemistry. Faure, G. Maxwell MacMillan International, 1991. ISBN 0023364416

Alternative Text
Geochemical Thermodynamics. Nordstrom, D.K. and Munoz, J.L. Blackwell Scientific, 1986.
ISBN 0865423199

Supplementary Text
Geochemistry in Mineral Exploration. Rose, A.W. Hawkes, H.E. and Webb, J.S. (2nd edition) Academic Press, 1979. (650 pp). ISBN 0125962525

2000-Glgy-8 Geophysics

Elasticity of rocks; types of waves generated in earthquakes and explosions; structure of the earth; gravity and the figure of the earth, earth tides; the magnetic field; secular variations; electromagnetic induction; rock magnetism; heat flow; geochronology; geodynamics.

Prime Text
The Solid Earth - An Introduction to Global Geophysics. Fowler, C.M.R. Cambridge University Press, 1990. ISBN 0521385903

Supplementary Text
The Inaccessible Earth. Brown, G.C. and Mussett, A.E. (2nd edition) Allen & Unwin, 1993. ISBN 041248160X

2000-Glgy-9 Geomorphology

Landforms and the processes which create and modify them; weathering, mass-wasting, stream erosion, wave erosion, wind erosion, glaciation and permafrost; study of landforms on aerial photographs and topographic maps.

Prime Text
Geomorphology: Third Edition - A Systematic Analysis of Lake Cenozoic Landforms.. Bloom, Arthur L., Prentice-Hall, Inc., 1998 (482 pp.).

Process Geomorphology: Third Edition. Ritter, Dale, Kochel, F.R. Craig, and Miller, J. R., Wm. C. Brown Co., Dubuque, Iowa, 1995. (546 pp).

Alternative Text
Geomorphology - A Systematic Analysis of Late Cenozoic Landforms. Bloom, A. (2nd edition) Prentice-Hall, Inc., 1991. ISBN 0133515605

Supplementary Text
Process Geomorphology. Ritter, D.F. (3rd edition) William C. Brown Co., Dubuque, Illinois, 1994. (603 pp). ISBN 0697076326

Landforms of Alberta: Interpreted from air photos and satellite imagery. Smith, D.G. Canadian Society of Petroleum Geologists, 1990. ISBN 0919975100

2000-Glgy-10 Glacial and Quaternary Geology

Elements of glaciology; character and origin of glacial deposits and landforms; geological processes, sediments and landforms in the periglacial environment; frozen and ground phenomena, including

permafrost; glacio-isostatic rebound and eustatic changes in sea level; glacial history of Western Canada.

Prime Text
Reconstructing Quaternary Environments. Lowe, J.J. and Walker, M.J.C. Addison Wesley Longman Pub. Ltd. (2nd edition), 1997.

Glaciers and Glaciation. Benn, B.I. and Evans, D.J.A. Arnold London, 1998.

Quaternary Geology of Canada and Greenland. Fulton, R.J. (editor) Geological Survey of Canada, Geology of Canada, No. 1 (also Geological Society of America. The Geology of North America, v. K-1) 1990. (839 pp.) ISBN 0660131145

2000-Glgy-11 Hydrogeology

The occurrence of groundwater; rock properties that affect groundwater, quality of groundwater; geology of groundwater basins; procedures for surface and subsurface investigations. Hydrology of groundwater flow, derivation of Darcy's law from fundamental concepts of fluid mechanics, and its generalization to spatially varied flows. Permeability parameters and validity of Darcy's law in terms of Reynold's number.

Prime Text
Groundwater. Freeze, R. Allan, and Cherry, J.A. Prentice Hall Inc., 1979. (604 pp).
ISBN 0133653129

Supplementary Text
Physical & Chemical Hydrogeology. Domenico, P.A. and Schwartz, F.W. John Wiley & Sons, 1991.
ISBN 047150744X

C. EXAMINATIONS IN ADDITIONAL GEOSCIENCE SUBJECTS (APPLICABLE TO SECTIONS II AND III)

2000-Glgy-12 Paleontology

Principles of classification; comparison of fossils with modern forms; classification and study of fossil invertebrates.

Prime Text
Fossil Invertebrates. Boardman, Cheetham & Rowell. Blackwell Scientific Publications, 1987. ISBN 0865423024

Alternative Text
Invertebrate Paleontology and Evolution. Clarkson, E.N.K. (3rd edition) Allen and Unwin, London, 1993. ISBN 0412479907

Supplementary Text
Atlas of Invertebrate Macrofossils. Murray, J. Longman Group Ltd, 1985. ISBN 0470200847

2000-Glgy-13 Petroleum and Natural Gas

Origin and distribution of petroleum. Geochemistry and maturation of organic matter; microbiological and thermal degradation of hydrocarbons, conventional and unconventional source and reservoir rocks; principles of primary and secondary migration; diagenesis of carbonate and clastic reservoir rocks, with reference to seals and traps.

Prime Text
Petroleum Geology. North F.K., Allan & Unwin, Boston, 1985. ISBN 041253830X

Petroleum Geochemistry and Geology. Hunt, J.M. (2nd edition) W.H. Greeman & Co., N.Y., 1995.

2000-Glgy-14 Economic Geology

The economics of exploration and exploitation with respect to metalliferous raw materials. Exploration logistics and planning. Property and prospect evaluation. Drilling and sampling techniques. Reserve and grade estimation.

Prime Text
Exploration and Mining Geology. Peters, W.C. (2nd edition) Wiley Press, 1987. ISBN 0471838640

2000-Glgy-15 Metallic Mineral Deposits

Processes of ore formation and concentration in association with all the major geological processes. Stratigraphic and structural control of ore deposits. Examples of the occurrence of the economically important types of deposits in Canada and the world. Study of ores in polished and thin section. The application of chemical principles to the understanding of ore deposits; solution chemistry, phase equilibria, isotope geochemistry. Exploration for, and evaluation of metallic mineral deposits.

Prime Text

Ore Geology and Industrial Minerals: An Introduction. Evans, A.M. (3rd edition) Blackwell Scientific. ISBN 063029536

Ore Microscopy and Ore Petrography. Craig, J.R. and Vaughan, D.J. (2nd edition) John Wiley and Sons, 1994. ISBN 0471551759

Supplementary Text

Ore Petrology. Stanton, R.M. McGraw-Hill, 1972. ISBN 0070608431

Exploration and Mining Geology. Peters, W.G. (2nd edition) Wiley Press, 1987. ISBN 0471838640

Porphyry Deposits of the Canadian Cordillera. CIM Special Vol. 15

2000-Glgy-16 Stratigraphy of Western North America

Historical geology of Western North America from the Precambrian to the Recent.

Prime Text

Western Canada Sedimentary Basin. Ricketts, B.D. (editor) Canadian Society of Petroleum Geologists, Calgary, 1989.

Supplementary Text

The Geology of North America - An Overview(Book and Maps). Vol. A of The Geology of North America, Geological Society of N. America, Boulder, Colorado. Edited by Bally, A.W. and Palmer, A.R., 1989. ISBN 0813752078

2000-Glgy-17 Geotectonics and Global Geology

Global aspects of plate tectonics and regional geology through time. Application of fundamental stratigraphic and structural principles. Contributions of geophysics, geochemistry, experimental and theoretical petrology to the modern plate tectonic model. Analysis and interpretation of major structural provinces as they relate to the plate boundary interactions.

Prime Text
Global Tectonics. Kearey, P. and Vine, E.J. Blackwell Scientific Publishing, 1990. ISBN 0632024240

Supplementary Text
The Evolving Continents. Windley, B.F. (3rd edition) J. Wiley and Sons (Toronto), 1995.

Plate Tectonics and Geomagnetic Reversals. Cox, A. Freeman, 1973.

2000-Glgy-18 Exploration Geophysics*

Principles and applications of the following geophysical techniques: seismic reflection, seismic refraction, gravity, magnetic, electric and electromagnetic radioactive, well logging.

*can include mining geophysics

Prime Text
Introduction to Geophysical Exploration. Keavey, P. and Brooks, M. (2nd edition) Blackwell Scientific Publishing, 1991. ISBN 0632029234

Applied Geophysics. Telford W.M., Geldart, L.P. and Sheriff, R.E. Cambridge University Press, 1990. Hardcover ISBN 0521326931, paperback ISBN 0521339383

Alternative Text
Basic Exploration Geophysics. Robinson, E.S. and C. Coruh, John Wiley & Sons, 1988. ISBN 047187941X

2000-Glgy-19 Optical Mineralogy/Advanced Mineralogy

Optical crystallography with indicatrix theory. Optical techniques in determinative mineralogy with emphasis on transmitted-light microscopy and its application to common rock-forming minerals. Mineral associations, textures and elementary ideas on the origin of igneous, metamorphic and sedimentary rocks.

Prime Text
Introduction to Optical Mineralogy. Nesse, W.D. (2nd edition) Oxford University Press, 1991. ISBN 0195060245

Supplementary Text
An Introduction to the Rock Forming Minerals. Deer, W.A. Howie, R.A. and Zussman, J. (2nd edition) Longman Publishing, 1992. ISBN 0470218096

2000-Glgy-20 Advanced Sedimentology

Processes of sedimentation: weathering, transportation, deposition and diagenesis; classification and description of the principal types of detrital and chemical sedimentary rocks.

Prime Text

Fluvial Sedimentology. Miall, A.D. (editor) Canadian Society of Petroleum Geologists, 1978. ISBN 0920230032

Recognition of Fluvial Deposition Systems & Their Resource Potential. Flores, R.M. and others (editors) Society of Economic Paleontologists & Mineralogists, Short Notes No. 19, 1985. ISBN 9995246007

Supplementary Text

Origin of Sedimentary Rocks. Blatt, H. Middleton, G.V. and Murray, R.C. (2nd edition) Prentice-Hall, Englewood Cliffs, N.J., 1980. (634 pp).

Facies Models. Walker, R.C. (Editor) (3rd edition) Geoscience Canada Reprint Series 1, 1992. ISBN 0919216498

2000-Glgy-21 Advanced Igneous and/or Metamorphic Petrology

Origin and formation of igneous and/or metamorphic rocks in the light of field, mineralogical, chemical and experimental evidence.

Prime Text

Igneous Petrogenesis. Wilson, M. Unwin Hyman Inc., 1989. Hardcover ISBN 0045520240, Paperback ISBN 0412533103

Principles of Igneous & Metamorphic Petrology. Philpotts, A.R. Prentice-Hall, 1990. ISBN 013691361X

Supplementary Texts

Thermodynamic Modeling of Geological Materials: Minerals, Fluids and Melts. Carmichael, I.S.E. and Eugster, H.P. (Editors) Mineralogical Society of America Reviews in Mineralogy, Vol. 17. Mineralogical Society of America, 1625 1 Street, N.W., Suite 414, Washington, D.C. (chapters 11, 12 and 13) 1987. ISBN 0939950219

Modern Methods of Igneous Petrology: Understanding Magnetic Processes. Nicholls, J. and Russell, J.K. Mineralogical Society of America Reviews in Mineralogy, Vol. 24, 1991. (chapter 1) ISBN 0939950294

Origins of Igneous Rocks. Hess, P.C. Harvard University Press, 1989. ISBN 0674644816

Metamorphic phase equilibria and pressure-temperature-time paths of metamorphism. Spear, F.S., 1993, Mineralogical Society of America Monograph, 789 p.

2000-Glgy-22 Advanced Geochemistry

Application of physical chemistry to problems in igneous, metamorphic and sedimentary geology. Use of thermodynamic calculations to estimate physical and chemical conditions of mineral stability.

Prime Text
Geochemical Thermodynamics. Nordstrom, D.K. and Munoz, J.L. (2nd edition) Blackwell Scientific, November 1994. ISBN 0865422745

2000-Glgy-23 Principles of Geotechnics

Geotechnical investigation, site surveys and exploration, geological aspects of a given site with regard to the engineering design of foundations, hydraulic structures and the stability of natural or man-made slopes and open cuts. Provision of advice on fluvial geomorphology. Mapping and comment on the geologic factors affecting tunneling. The emphasis is the application of geologic expertise by the provision of geologic information in the form of maps and reports concerning design and construction of engineering projects.

Prime Text
Principles of Engineering Geology. Johnson, R.B. and DeGraff, J., John Wiley & Sons, 1988. 15BN 0471034363.

Supplementary Text
Engineering Geology and Geotechnics. Bell, F.G. Newness, Butterworths Co., 1980.

Principles of Engineering Geology and Geotechnics. Krynine, D.P. and Judd, W.R. McGraw-Hill, 1975.

2000-Glgy-24 Advanced Paleontology

Nomenclature and taxonomy, the species concept, mechanisms of evolution, adaptation, biometrics, paleoecology and preparatory techniques.

Prime Text
Paleobiology and Synthesis. Editors: Derrick Briggs and Peter Crowther. Blackwell Scientific Pub., 1990. ISBN 0-632-02525-5

Taphonomy: Releasing the Data locked in the Fossil Record. Editors: Peter Allison & Derrick Briggs, Plenum Pub., 1991. ISBN 0306438763

Paleoecology, Concepts and Applications. Dodd, J.R. (2nd edition) Wiley Interscience, John Wiley, New York, 1990. ISBN 0471857114

2000-Glgy-25 Advanced Structural Geology

Structural features of complexly folded and faulted strata. Simple statistical analysis of structural data. Analysis of strains. Computer-based procedures for determining the geometry of faults and folds. Structural analysis in plutonic and metamorphic rocks.

Prime Texts

Analysis of Geological Structures. Price, N.S. and Cosgrove, J.W. Cambridge University Press, 1990. ISBN 0521319587

The Techniques of Modern Structural Geology (Vols 1 and 2) Ramsay, T.J. and Huber M.I. Academic Press, 1983 and 1987. Vol 1 - 1983, Hardcover ISBN 0125769016, Paperback ISBN 0125769210. Vol 2 - 1987, Paperback ISBN 0125769229

2000-Glgy-26 Geostatistics

Analysis of quantitative geological data using digital computers, simple and multivariate statistical models (multiple regression, factor analysis and discriminant functions). Application of these methods to real and hypothetical geological situations.

Prime Text

Numerical Geology. Rock, N.M.S. Lecture Notes in Earth Sciences, vol. 18. Springer-Verlag, 1988. ISBN 0387500707

Supplementary Text

Statistics and Data Analysis in Geology. Davis, J.C. (2nd edition) John Wiley and Sons, 1986. (550 pp). ISBN 0471080799

2000-Glgy-27 Advanced Hydrogeology

Chemical and contaminant hydrogeology. Chemical and biological processes in surface water and groundwater systems. Water quality, contaminant transport and dispersal, fluid-sediment interaction, remediation of contamination. Use of thermo chemical models, numerical modelling of contaminant migration, case studies.

Prime Text
Physical and Chemical Hydrogeology. Domenico, P.A. and Schwartz, F.W., John Wiley, 1991. ISBN 047150744X

Supplementary Text
The Geochemistry of Natural Waters. Dever, J.I. (2nd edition) Prentice Hall, 1988. ISBN 0133513963

2000-Glgy-28 Reservoir Geology

Core analysis; methods for porosity, permeability and fluid saturation, and the conditions under which each method can be used. Log interpretation; use of logs for correlation and mapping, as well as for the determination of reservoir parameters - porosity, permeability, pore water. Drill stem tests, the reading of DST charts, significance and interpretation of pressure curves. Reservoir rocks and reservoir pore space characteristics; factors influencing porosity and permeability. Measurement methods. Reservoir fluids, reservoir conditions and reservoir mechanics.

Prime Text
The Reservoir Engineering Aspects of Water Flooding. Craig, F.F. Henry L. Doherty Series, Society of Petroleum Engineering of AIME, 1976. ISBN 0895202026

Petroleum Development Geology. Dickey, P.A. (3rd edition) PPC Books, Division of the Petroleum Publishing Co., 1421 South Sheridan Road, P.O. Box 1260, Tulsa, Oklahoma, 74101, U.S.A., 1986. (428 pp) ISBN 0878143076

Supplementary Texts
Elements of Petroleum Reservoirs. Clark, N.J. (2nd edition) Henry L. Doherty series, Society of Petroleum Engineers of AIME, 1969. ISBN 0895202093, 250 pages.

Petroleum Production Handbook, Vol. II Reservoir Engineering. Frick, T.C. and Taylor, R.W. Society of Petroleum Engineers of AIME, second printing, 1962. ISBN 0895202077.

2000-Glgy-29 Advanced Ore Deposits

A detailed study of ore occurrences and processes of formation with emphasis on Canadian deposits.

Prime Text
The Geology of Ore Deposits. Builbert, J.M. and Park, C.F. (4th edition) C.F. Freeman & Co., 1986. ISBN 0716714566

Supplementary Text

Ore Deposit Models. Roberts, R.G. and Sheaham, P.A. (editors) Geoscience Canada Reprint Series 3, 1988. ISBN 091921634X

Geochemistry of Hydrothermal Ore Deposits. Barnes, H.L. (editor) (2nd edition) John Wiley and Sons.

Porphyry Deposits of the Canadian Cordillera. CIM Special Vol. 15.
Ore Microscopy and Ore Petrography. Craig, J.R. and Vaughn, D.J. (2nd edition) John Wiley and Sons, 1994. ISBN 0471551759

Metal Deposits in Relation to Plate Tectonics. Sawkins, F.J. (2nd edition) Springer Verlag, New York, 1989. ISBN 0387509208

2000-Glgy-30 Photogeology and Remote Sensing

Application of aerial photographs to geological mapping and terrain analysis; interpretation of geological structure and landforms; remote sensing in geology; sensor principles and capabilities; analysis of imagery.

Prime Text
Remote Sensing and Lineage Interpretation. Lillesand, T.M. and Kiefer, R.W. (3rd edition), John Wiley, 1994. (750pp) ISBN 0-471-57783-9.

Air photo Interpretation and the Canadian Landscape. Mollard, J.D. and Janes, J.R. Energy, Mines, and Resources Canada, 1984. (415 pp).

Supplementary Text
Interpretation of Aerial Photographs. Avery, T.E. (4th edition) Burgess, 1984. (415 pp).

Remote Sensing in Geology. Siegal, B.S. and Gillespie, A.R. Wiley, 1980. (702 pp).

Remote Sensing Principles and Interpretation. Sabins, Jr., F.F. (2nd edition) Freeman, 1986. ISBN 071671793X (426 pp).

A Guide to Remote Sensing. Davry, S.A. Oxford. (199 pp), 1990. ISBN 0-19-854494-4.

2000-Glgy-31 Precambrian Geology

The Precambrian geologic record with special reference to the stratigraphy, structure, petrology, mineral deposits, geochronology and metamorphism of the Shield areas of North America.

Prime Text
The Evolving Continents. Windley, B.F. (3rd edition) J. Wiley and Sons 1995. ISBN 047197397

Plate Tectonics and Crustal Evolution. Condie, K.C. (3rd edition) Pergamon Press, 1989. Hardcover ISBN 0080348734, Paperback ISBN 0080348734

APPENDIX: Examiner check sheet

APEGGA Geology Academic Assessment: Course-by-Course Equivalent Credits (rev. 08/00)

Applicant name: _____

FUNDAMENTAL SCIENCE (Total 9)

ALL 3:

2000-F-1a Elementary Calculus I ____
2000-F-2a General Physics I ____
2000-F-3a General Chemistry I ____

AND 3 OF:

2000-F-1b Elementary Calculus II ____
2000-F-2b General Physics II ____
2000-F-3b General Chemistry II ____
2000-F-8 Biology ____

AND 3 OF:

2000-F-4 Diff. Eqns & Transforms ____
2000-F-5 Lin. Algebra. & Vector Anal. ____
2000-F-6 Computing & Numerical Anal. ____
2000-F-7 Thermodynamics ____
2000-F-9 Physical Chemistry ____
2000-F-10 Organic Chemistry ____
2000-F-11 Inorganic Chemistry ____
2000-F-12 Statistics ____

OR:

_____
_____
_____

*Other advanced university courses in **mathematics, physics, chemistry, statistics, computing or biology** can fulfil requirements of three subjects. Maximum two biology credits in the total of 9 fundamental sciences.*

GEOSCIENCE (Total 20) (A + B + C = 20)

SECTION A: FIELD PRACTICE

(Required Field Practice; no examination offered) ___

SECTION B: FUNDAMENTAL GEOSCIENCE

EITHER: *(Minimum 5, maximum 6)*

2000-G-1 Mineralogy & Crystallog. ____
2000-G-2 Stratig. & Sedimentation ____
2000-G-3, 4, 5 Petrology (any one) ____
2000-G-6 Structural Geology ____
2000-G-7 Geochemistry ____

OR: *(Minimum 5, maximum 6)*

2000-G-1 Mineralogy & Crystallog. ____
2000-G-2 Stratig. & Sedimentation ____
2000-G-7 Geochemistry ____
2000-G-9 Geomorphology ____
2000-G-10 Glacial & Quaternary ____

2000-G-8 Geophysics ____ 2000-G-11 Hydrology or Hydrogeology ____

SECTION C: OTHER GEOSCIENCE
(*Additional 14: min 12 in geoscience, max 2 in other science****)***

1	____	8	____
2	____	9	____
3	____	10	____
4	____	11	____
5	____	12	____
6	____	13	____
7	____	14	____

COMMENTS: