

PRINCIPAL SUBJECT AREA

GEOLOGY

400 LEVEL COURSES

GL 401 Applied Hydrogeology (2 credits)

Groundwater exploration. Well design and construction. Evaluation of aquifer properties. Well hydraulics. Pumping equipment. Quality of groundwater and water treatment. Groundwater recharge and balance. Groundwater development and management.

Recommended Texts:

1. Fetler, C.W. (1994) *Applied hydrogeology* (3rd Ed.) Prentice Hall, Englewood Cliffs, NY
2. Kamath, K.R. (1993) *Groundwater assessment, development and management*. Tata McGraw Hill Publishing Co., New Delhi.
3. Todd, D.K. (1980). *Groundwater Hydrogeology*, John Wiley & Sons, 525 pp.

GL 402 Soils and Quaternary Geology (2 credits)

Soils as a product of the natural environment with focus on formative processes and classification. Soil conservation; The soils of Sri Lanka; Major events and the significance of the Quaternary period with special reference to Quaternary Geology of Sri Lanka.

Recommended Texts:

1. Cooray, P.G. (1965). *The geomorphology of part of the north-western coastal plain of Ceylon*, Zeitschrift fuer Geomorphologie, 7: 95-113.
2. Cooray, P.G. (1968). *A note on the occurrence of beach rock along the west coast of Ceylon*.
3. Panabokke, C.R. (1996) *Soils and agro-ecological environments of Sri Lanka*, Natural Resources Series No. 2, NARESA, Colombo, 220.

GL 403 Precambrian Geology (2 credits)

Precambrian and its subdivisions, Introduction to the Precambrian rock occurrence of the World. Geology of the Precambrian lithosphere. Precambrian atmosphere, biosphere and hydrosphere. Models of evolution of the earth. Precambrian geology of Sri Lanka and its relationships with Gondwana land mass.

Recommended Texts:

1. Kröner, A., (1984). *Precambrian Plate Tectonics*, Elsevier, Amsterdam.
2. Nisbett, E.G. (1980). *The Young Earth*, Allen & Unwin, 402pp
3. Condie, K.C. (1980). *Archaean Geochemistry*, Elsevier
4. Rogers, J.J.W. (1981). *Early History of the Earth*

GL 404 Isotope Geology (2 credits)

Isotopes - stable and radioactive, stable isotope fractionation, stable isotopes in the lithosphere, hydrosphere and biosphere and the mantle and their applications in geology. Radioactive isotopes, their decay schemes and use in isotopic dating of minerals and rocks and inference of geological history of earth materials.

Recommended Texts:

1. Hoefs, J. (1997) *Stable isotope geochemistry*, Springer, 201 pp.
2. Faure, G. (1976) *Isotope Geology*, John Wiley.
3. Dickin, P. (1998) *Radiogenic Isotope Geology*, Camb. Univ. Press.

GL 405 Applied Geophysics (2 credits)

Principles of applied geophysics. Investigations of earth resources and geologic structures by Geophysical methods, Seismic Surveying, Gravity Surveying, Magnetic Surveying, Electrical Surveying, Electromagnetic surveying, Bore hole geophysics.

Recommended Texts:

1. Keary, P. and Brooks, M., (1992) 2nd Ed. *An introduction to geophysical exploration*. Black Well Scientific Pub.
2. Kelly, W.E. and Mares, S. (1993) *Applied geophysics in hydrogeological and engineering practices*.

GL 406 Oceanography and Coastal Geomorphology (3 credits)

Sea flow spreading and tectonic history of the Indian Ocean. Physical properties of sea water, distribution of temperature, salinity and density in space and time, light in the sea, oceanic water circulation, major and minor elements in sea water, geochemical balance of the oceans, residence times, dissolved gasses in sea water, sea as a biological environment, effects of temperature, salinity, pressure and light on marine organisms. Distribution and composition of marine sediments. Formative processes and classification of coastal land forms with emphasis on coastal geomorphology of Sri Lanka. Coastal process and environments. Coastal and marine pollution.

Recommended Texts :

1. Chester (1990) *Marine geochemistry*.
2. Millero and Saha, M.L. (1992) *Chemical Oceanography*.
3. McCormick, M.J. and Thiruvathukal, J.V. (1981) *Elements of Oceanography*, Saunders College Publishing.
4. Swan, B. (1983) *An introduction to the coastal geomorphology of Sri Lanka*, National Museums of Sri Lanka.

GL 407 Surveying and Levelling (2 credits)

Introduction to surveying. Basic principles of surveying. Maps and plans. Chain surveying. Plotting and Checking. Principles and use of Theodolite and levelling instruments, traversing, traverse computations, and plotting. Other methods of surveying-triangulation. Plane Table surveying and Tacheometry levelling-Plotting Cross Sections and Longitudinal Sections, Contouring.

Recommended Texts:

1. Bannister, A. Sand Raymond, S. (1999). *Surveying*, ELBS/Pitman.
2. Kavanagh, Barry F. And Glenn Bird, S.J. (1998). *Surveying principles and applications*. Reston Pub., USA

GL 408 Energy Resources (1 credit)

Introduction. Nature, occurrence, distribution and origin of peat, coal and petroleum. Reservoir rocks. Evaluation and prospecting for energy resources. Introduction to geothermal and nuclear energy, their systems, applications, productions and economics.

GL 409 Advanced Metamorphic Petrology (3 credits)

(Prerequisite: GL 312)

Principles and application of thermodynamics to mineral equilibrium in metamorphic rocks. Quantitative approaches in metamorphic petrology. Geothermometry and Geobarometry. Principles and application of the P-T-t path concept. P-T-t path case studies, P-T-t path determination using compositional zoning in minerals. Laboratory study of P-T-t history of metamorphic terrain using mineral reactions and reaction textures in thin sections. Introduction to experimental petrology

Recommended Texts:

1. Spear, F.S., (1994). *Metamorphic Phase Equilibria and Pressure-Temperature-Time Paths* Min. Soc. Am.
2. Bucher, K. and Frey, M. (1994). *Petrogenesis of metamorphic rocks*, Springer Verlag, Heidelberg.
3. Wood, B.J. & Fraser, D.G. (1976) *Thermodynamics for Geologists*, Oxford Univ. Press, 303pp

GL 411 Structural Geology and Tectonics (2 credits)

Crystal defects and deformation mechanisms. Concept of strain ellipse and ellipsoid. Ductile structures such as foliations, lineations, folds, boudins and shear zones. Mechanism(s) of their formation. Folding, elements of fold style and fold mechanism. Introduction to structural geology and tectonics of Sri Lanka. Geodynamic evolution of Sri Lanka. Plate tectonics in detail. Concept of formation and break-up of supercontinents. Tectonics in the Indian Ocean region. Study of microscopic to megascopic structures and related fabrics in the field for practical classes. Lectures have to be supplemented by preparations of essays and seminar presentations by students.

Recommended Texts:

1. Ramsay, J.G., 1967. *Folding and fracturing of rocks*. McGraw Hill, New York, 568 pp.
2. Ramsay, J.G. and Huber, M.I., (1983). *The techniques of modern structural geology, Vol. I, Strain Analysis*, Academic Press, London, 307 pp.
3. Ramsay, J.G. and Huber, M.I., (1987). *The techniques of modern structural geology. Vol. II, folds and fractures*, Academic Press, London, p. 308-700.
4. Passchier, C.W., Myers, J.S., Kröner, A., 1990. *Field geology of high-grade terrains*. Springer-Verlag, Berlin, 150 p
5. Passchier, C.W. (1996). *Microtectonics*, Springer-Verlag.

GL 412 Mineral Exploration and Mining Geology (2 credits)

Methods of exploration and mining geology, including mapping, geophysics, remote sensing, exploration geochemistry, inclusion studies and diamond drilling. Technical and economic aspects of exploration programme design and reserves evaluation procedures. Open cast mining, underground mining, mining in the soft ground, underwater and deep sea.

Recommended Texts:

1. Hood, Peter J. (Editor), 1977, Geophysics and geochemistry in the search for metallic ores, Proceedings of Exploration 77, an international symposium held in Ottawa, Canada, Economic Geology Report No. 31, Geological Survey of Canada.
2. Kearey, P. and Brooks, M. (1991) An Introduction to Geophysical Exploration (2nd Ed.) Blackwell Scientific Publications.
3. Telford, W.M.; Geldart, L.P; Sheriff, R.E., (1990), Applied Geophysics (2nd Ed.) Cambridge Univ. Press, New York, Port Chester, Melbourne, Sydney.

GL 413 Advanced Igneous Petrology (3 Credits)

(Prerequisite: GL 314)

Application of phase diagrams, experimental petrology, and field and petrographic relationships to the origin of magmas. Layered intrusions, Ophiolite complex, Igneous processes and global tectonics field trips. Petrographic studies on layered rocks, associations and ophiolite complexes.

Recommended Texts:

1. Hall, Anthony (1985) *Igneous Petrology 2nd ed.* Unwin Hyman.
2. Yoder, H. S. (1979) *The evolution of the igneous rocks.* Princeton University Press

GL 414 Advanced Environmental Geology (2 credits)

(Prerequisite: GL 306)

Natural environment, particularly geologic factors that may impact upon human life or way of life, Environmental problems and possible alternative solutions to such problems The biogeochemical cycles of water, carbon, nitrogen, and sulfur; the interactions among major biogeochemical cycles and resultant global change. Health and disease, waste disposal, water, mineral and energy resources and conservation, land reclamation, land-use planning.

Recommended Texts:

1. Hsai Yang Fang, *Introduction to Environmental Geotechnology* (1997) CRC Press, Boca Raton, New York.
2. Perry H. Rahn, *Engineering Geology – An Environmental Approach*, 2nd ed. Prentice Hall, New Jersey.

GL 415 Environmental Geochemistry (2 credits)

(Prerequisite: GL 207)

Geochemistry of ecosystems; Heavy metal pollution; sources and origins of heavy metals in the environment; mobility and immobility of heavy metals in environmental media; bioaccumulation; Dose-response relationships, toxic elements and elemental forms; Medical geochemistry; Geochemical health problems pertaining to Sri Lanka.

Recommended Texts:

1. Siegel, F.R. (2002). *Environmental geochemistry of potentially toxic metals*, Springer, 218 pp.
2. Deutch, W.T. (1989). *Groundwater Geochemistry*, Lewis Publishers Boca Raton, New York.
3. Dissanayake, C.B. and Chandrajith, R. (1999). *Medical geochemistry of tropical environments*, Earth Science Reviews, Vol. 47, 219-258.

GL 417 Geologic and Hydrologic Hazards (Prevention and Mitigation) (2 credits)

Landslides-causes, types and processes of slope movement, slope stabilization and mitigation, landslide hazard zonation maps. **Earthquake**-ground shaking, surface faulting, ground failure, subsidence, Tsunamis, Tsunami Warning System, Reduction of losses from earthquakes and tsunamis. **Floods** – causes of flooding, Flash flooding, Riverine floods, Tidal floods, Reduction of losses from floods. **Volcanic eruptions** – different kinds, hazards from volcanoes, forecasting of volcanism, Reduction of losses from volcanism.

Recommended Texts:

1. Blatt, H. (1997) – Our Geologic Environment, Prentice Hill, 541 p.
2. Coburn, A. and Spence, R. (1992) – Earthquake Protection, Wiley Publishers, 355 p
3. Hays, W.W. (1981) – Facing geologic and hydrologic hazards – Earth Science considerations. USGS Professional Paper 1240-B 108 p.
4. Murck, B.W. et.al. (1996) Environmental geology, John Wiley, 535 p.
5. McCall, G.J.H. et.al. (1992) Geohazards-natural and man made, Chapman and Hall, 227 p
6. Page, Robert A. et.al. (1992) Goals, opportunities and priorities for the USGS earthquake hazard reduction program. USGS Circular 1079.

GL 418 Advanced Engineering Geology (2 credits)

(Prerequisites: GL 203, GL 307)

Earth moving. compaction and stabilization. Foundations; types, designs and methods. Lateral pressures and retaining structures. Problematic soils and rocks. Slope stability investigations. Stability analysis. Environmental geotechnical applications. Preparation of geotechnical reports. Ethics in geology.

Recommended Texts:

1. McCarthy, P.E. (1993). *Essentials of soil mechanics and foundations*, Prentice Hall.
2. Fand, Hsai-Yang (1997). *Introduction to geotechnology*, CRC Press, Boca Raton, NY

GL 419 Petroleum Geology and Exploration (1 Credit)

Mode of occurrences and petroleum genesis. Organic matter in depositional environment, preservation and maturation. Migration, traps and reservoirs of petroleum. Tectonic approach in petroleum exploration. Geophysical techniques in petroleum exploration. Petroleum prospects of the Gulf of Mannar.

Recommended Texts:

1. Elements of Petroleum Geology, Richard C. Selby ISBN 0-126-36370-6

GL 420 Advanced GIS (2 credits)

(Prerequisite: GL 316)

Applications of GIS, Development in GIS Technology. Accuracy of Geo-spatial Databases. Functional Elements of GIS, Mapping Concept-Map elements, Map scales and representation, Map Projection, Geometric Rectification, Data Compression Techniques. Laboratory sessions on data acquisition, digitization, Global Positioning System (GPS) based data acquisition, Data Manipulation and Analysis. Spatial Accuracy Assessment – Data Quality, Map Output Generation, Spatial analysis, Mini-project for GIS application.

Recommended Texts:

1. P.A. Burrough and R.A. McDonnell (1998). *Principles of Geographical Information Systems*, Oxford University Press.
2. S. Murai (1998) *GIS Working Book*, Japan Association of Surveying.

GL 421 Project Proposal and Report Writing (1 credit)

Research Project, EIA, Budget estimation, Writing scientific papers and reports

Recommended Texts:

1. Cooray, P.G. (1992) Guides to Scientific and Technical Writing.

GL 422 Seminar on Special Topics in Geology (1 credit)

A structured program of reading and seminars leading to an in-depth understanding of a chosen topic in geology. Students may repeat course once for an additional two or three credits

GL 423 Research Project (6 credits)

Field/Laboratory studies on a problem of current geological interest. A detailed report has to be submitted incorporating objectives, methodology, results, interpretation, conclusions and bibliography. An oral examination based on the project will be held as part of this course. The candidate will have to make a summary presentation of the project at this oral examination conducted by a panel of Senior teachers/researchers.

GL 424 Field Geology Assessment (2 credits)

Each student is required to individually prepare a detailed geological/structural map of a given area and submit a report, and may be required to make an oral presentation, on the basis of his/her study. The report (and the presentation) shall consist of laboratory studies pertaining to the area in addition to the field observations. The map and the report will be assessed and graded. A student is required to spend at least a minimum of 90 hours to complete the field work component of this assessment.

GL 427 Seismology (2 credits)

Seismic waves and earth models, Seismic sources and source parameters, Seismic signals and noise, Seismic sensors and recording systems, Site selection, preparation and installation of seismic stations, Seismic networks and arrays, Seismic data formats archival and exchange, Data analysis and interpretation, Seismic hazard assessment.

Recommended Texts:

1. Havskov, J. & Alguavil, G. (2004) Instrumentation in Earthquake Seismology, Springer, 358 pp.
2. Stein, S. & Wysession, M. (2003) An Introduction to Seismology, Earthquakes and Earth Structure, Blackwell, 498 pp.
3. Shearver, P.M. (1999) Introduction to Seismology, Camb. Univ. Press. 260 pp.
4. Lay, T. & Wallace, T.C. (1995) Modern Global Seismology, Academic Press, 521 pp.

GL 428 Advanced Sedimentary Petrology (3 credits)

(Prerequisite: GL 317)

Introduction-basic concepts and methodology; siliciclastic sediments- sandstones and sandstone diagenesis, conglomerates, breccia, mud rocks; chert and siliceous sediments. Carbonate sediments and limestones- carbonate diagenesis and microfibrics; dolomitization and dedolomitization; Evaporites and sequences; sedimentary ironstones and iron formations Phanerozoic and the Precambrian); sedimentary phosphate deposits, nodular and bedded phosphorite, bioclastic and pebble bed phosphorites, Guano phosphorites; geology of fluvial deposits, coal, oil shale and petroleum, petroleum source rocks; volcaniclastic sediments; origin and mineralogy of clays

Recommended Texts:

1. Sedimentary Petrology by M.E. Tucker, Blackwell 1996
2. Carbonate microfibrics by R. Rezac and D.L. Lavoie Springer Verlag 1990
3. Marine phosphorites – geochemistry, occurrence and genesis by Y.K. Bendor, Society of Economic Paleontologists and Mineralogists 1980.
4. Direct Application of Phosphate Rock and appropriate technology fertilizers in Asia by K. Dahanayake, S.J. Van Kauwenbergh and D.T. Hellums- IFDC Alabama/ IFS Kandy Publication 1995
5. Phosphorite Research and Development by A.J.G. Notholt and I. Jarvis – Geological Society of London Publication 1990
6. Origin and Mineralogy of Clays by B. Velde Springer Verlag 1995