

# PRINCIPAL SUBJECT AREA

## GEOLOGY

### 300 LEVEL COURSES

#### GL 301 Introduction to Structural Geology and Tectonics (2 credits)

Concepts of force, stress, strain and deformation. Brittle and ductile deformations. Fractures and faults and their origins. Concept of stereonet and graphical analysis of structural data. Importance of structures in economic geology, ground water exploration and engineering geology. Study of structural features in hand-specimens and in the field. Interpretation of geological and structural maps. Mesoscopic, macroscopic and megascopic structures should be studied in the field.

##### Recommended Texts:

1. Ramsay, J.G., 1967. *Folding and fracturing of rocks*. McGraw Hill, New York, 568 pp.
2. Phillips, F.C., 1971. *The use of the stereographic projection in structural geology*. 3<sup>rd</sup> Edition, Edward Arnold.
3. Ramsay, J.G. and Huber, M.I., (1983). *The techniques of modern structural geology, Vol 1, Strain Analysis*, Academic Press, London, 307 pp.
4. Ragan, D.M., 1985. *Structural geology: An introduction to geometrical techniques*, 3<sup>rd</sup> Edition, John Wiley, New York.
5. Ramsay, J.G. and Huber, M.I. (1987). *The techniques of modern structural geology. Vol. II, folds and fractures*, Academic Press, London, pp.308-700.

#### GL 302 Photogeology (2 credits)

Basis of photogrammetry, practical uses of aerial photographs in structural geology, economic geology, geomorphology, hydrology, hydrogeology, geography, agriculture and land-use. Guided geo-mapping in a selected area and its geological and structural analysis. Submission of geological report by individual students. Visual interpretation of aerial photographs, resource exploration, land-use, land pattern analysis.

##### Recommended Texts:

1. Avery, Eugene T. (1968). *Interpretation of aerial photographs*, Second Edition.
2. Miller and Miller. *Photogeology*

#### GL 303 Geomorphology (1 credit)

Landform types, climate, climatic changes and landform development. Volcanic landforms. evolution of karst landforms, structural landforms, methods of analysis. Geomorphological analysis of Sri Lanka.

##### Recommended Texts:

1. Thornbury, William D. (1966). *Principles of Geomorphology*, John Wiley & Sons., 618pp.
2. Reinic and Singh. *Tropical geomorphology*

#### GL 304 Geophysics (2 credits)

Introduction to geophysics, structure of the Earth. Earth's gravity field, seismicity and earthquakes, geomagnetism, paleomagnetism, radioactivity and radioactive dating, Earth's internal heat, geo thermal energy.

##### Recommended Texts :

1. Sleep and Norman (1997). *Principles in geophysics*.
2. Dmowska and Rena (1996). *Advances in Geophysics*.
3. Vogelsang, D. (1994). *Environmental geophysics*

#### GL 306 Environmental Geology (2 credits)

Introduction to environment; environmental issues, resources and the environment; Pollution of the Earth's environments (atmosphere, water and soil). Environmental effects of geological resource extraction, conserving mineral resources, geological hazards; urbanization and sustainable cities; Environmental Impact Assessment (EIA) and EIA processes.

##### Recommended Texts :

1. Fergusson, J.E. (1982). *Inorganic chemistry and the earth*. Pergmon Series on environmental sciences, Vol. 6, 400pp.
2. Stumm and Morgan. *Aquatic chemistry*.
3. Andrews, J.E., et. al. (1996). *An Introduction to Environmental Chemistry*, Blackwell Scinces, 209 pp.

### **GL 307 Engineering Geology (2 credits)**

Engineering properties and classification of soils and rocks, stability of slopes and mass movements, site investigations for building, dams, reservoirs, tunnels and highways. Rocks and soils as construction materials. Laboratory studies of engineering properties of soils and rocks, use of maps as a tool in engineering geological studies.

Recommended Texts :

1. Bell, F.G. Fundamentals of Engineering geology.
2. Bell, F.G. Engineering geology and geotechniques.
3. Goodman, R.E. Engineering Geology

### **GL 308 Introductory Hydrogeology (2 credits)**

Surface and sub-surface distribution of water. Unsaturated and saturated zones, aquifers and their properties. Darcy's law and groundwater flows. Draw-down discharge relationships. aquifer types and groundwater environments. Chemical characteristics of groundwater. Field and Laboratory studies hydrogeological properties of soils and rocks. Maps, airphoto and satellite imagery interpretations in groundwater studies. Laboratory and field exercises in hydrogeology.

Recommended Texts:

1. Fetter, C.W. (1994) *Applied hydrogeology – 3<sup>rd</sup> Ed.*, Prentice Hall, Englewood Cliffs, NY.
2. Karnath, K.R. (1993) *Groundwater assessment development and management*, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3. Todd, D.K. (1980). *Groundwater Hydrology*. John Wiley and Sons, 535 pp.

### **GL 309 Hydrology (2 credits)**

Introduction to basic principals of hydrology including mathematical, physical and chemical concepts. Discussion on practical applicability of common-used analytical techniques in understanding the different components of the hydrological cycle – climate, precipitation, evapo-transpiration, runoff and infiltration. Hydrological Cycle - sources of stream flow, uniform and steady state flow. Hydrographs and hydrologic routing; basin study and water balance, probability and statistical techniques, Computer applications in hydrology.

Recommended Texts:

1. Ven T. Chouw. (1964). *Handbook of applied hydrology – A compendium of water resource technology*, McGraw-Hill.
2. Linsley, R.K., Kohler, M.A. and Paulthus, J.L.W. (1982). *Hydrology for engineers*, 3<sup>rd</sup> Ed. Mc Graw-Hill, 508pp.

### **GL 310 Geology of Sri Lanka (2 credits)**

Introduction to lithology, structure, tectonics and geomorphology of Sri Lanka. Subdivision of the Precambrian and Phanerozoic rocks of Sri Lanka. Sri Lanka in Gondwanaland. Metamorphic and structural history of Sri Lankan rocks. Geochemistry of Sri Lankan rocks, soils and waters. Mineral resources.

Recommended Texts:

1. Cooray, P.G (1984). *An introduction to geology of Sri Lanka*, National Museum Publ.
2. Kröner, A. (1991) (Ed.) *The Crystalline crust of Sri Lanka, Part 1, summary of research of the German-Sri Lankan consortium*, Geological Survey Department Professional. Paper 5

### **GL 311 Geological Data Analysis (2 credits)**

Familiarizing with software tools in quantitative data analysis, describing and comparing data populations, simple data manipulations, creating and working with databases, surface contouring and modeling, graphic data representation, and simple computer modelling of geological processes. Basic statistics (curve fitting, error analysis, hypothesis testing, univariate data analysis, bivariate data analysis, multivariate data analysis). Multivariate model developments in geology; using principal component analysis, discriminant analysis, cluster analysis. Students will be exposed to a suite of relevant software.

Recommended Texts:

1. Davis, John C. (1986). *Statistics and data analysis in geology*, John Wiley & Sons, 646pp.
2. Swan, A.R.H. (1995). *Introduction to geological data analysis*, Blackwell Science, 446pp.
3. Hamburg, Morris (1979). *Basic statistics: a modern Approach*, Harcourt Brace Jovanovich International Edition, 496pp.

### **GL 312 Metamorphic Petrology (3 credits)**

(Prerequisites: GL 201, GL 205)

Phase rule and equilibrium in metamorphic rocks. Equilibrium mineral assemblages and their graphical representation using ACF, AKF, AFM diagrams. Disequilibrium, textures of disequilibrium, and metamorphic reactions. Spatial distribution of equilibrium mineral assemblages. Depth zones to facies concept. Facies series of metamorphism, granulite facies. Schreinemeker's Method of graphical representation. Laboratory study of hand-specimens and thin-sections of rocks of various facies subfacies and facies series. Laboratory exercises on Schreinemeker's method.

Recommended Texts:

1. Bucher, K. and Frey, M (1994). *Petrogenesis of metamorphic rocks*, Springer Verlag, Heidelberg.
2. Philpotts, Anthony R. (1990). *Principals of igneous and metamorphic rocks*, Prentice Hall Pub.
3. Yardley, B.W.D. (1989). *An introduction to metamorphic petrology*, Longman Publishers, 248 pp.
4. Yardley, B.W.D. and Mackenzie, W.S. (1990). *Atlas of metamorphic rocks and their textures*, John Wiley and Sons, NY.

### **GL 313 Applied Analytical Techniques in Geology (2 credits)**

Sampling methods (geological and environmental); Principles of X-Ray Diffractometry (XRD), X-ray Fluorescence (XRF) spectroscopy, Electron Probe Micro Analysis (EPMA), Atomic Absorption Spectrophotometry (AAS), and Inductively Coupled Plasma (ICP) with applications to earth sciences; Quality control in sampling and analysis. Lectures on theory are followed by hands-on laboratory exercises. Interpretation of analytical results; identification of minerals, calculation of chemical formula of minerals, mineral recalculation, graphical representation and substitution

Recommended Texts:

1. Fletcher, W.K. (1981). *Analytical methods in geochemical prospecting. Handbook on exploration Geochemistry*, Vol. 1, Govett, G.J.S. (ed.), Elsevier, The Netherlands, 255p.

### **GL 314 Igneous Petrology (3 credits)**

(Prerequisites: GL 201, GL 205)

Principles of partial melting, crystallization, intrusion and eruption, Magmatic processes: fractionation, magma mixing and assimilation, Kinetics of crystallization, Rock associations. Hand-specimen and thin-section study of igneous rocks

Recommended Texts :

1. Wilson, M. (1989) *Igneous Petrogenesis*, Unwin Hyman
2. Best, M.G., (1982) *Igneous and Metamorphic Petrology*, Freeman and Sons.

### **GL 315 Advanced Economic Geology (1 credit)**

(Prerequisite: GL 202)

Physico-chemical characteristics of mineral deposits, volcanogenic ore deposits Cu-Zn, Pb-Zn, Cu-Mo... etc.) Mineral deposits in sedimentary and metamorphic environments, non metallic deposits, precious metals and minerals, examples of world's typical mineral deposits, uses of minerals, overview of ore genesis related to plate tectonics.

Recommended Texts :

1. Anthony, M. Evans (1993), *Ore Geology and Industrial Minerals – An Introduction* 3<sup>rd</sup> Ed., Black-WQell Scientific Pub. – Sci. Lib.
2. Richard Edwards & Keith Aitkinson (1985), *Ore Deposits Geology*, Chapman & Hall, London, Main/Sci. Lib.
3. Wolf, K.H. (1980) *Handbook of Strata Bound and Stratiform Ore Deposits*, Elsevier Publishers – Sci. Lib.
4. Herath, J.W., (1975), *Economic Geology of Sri Lanka* (Natural Resources Series No. 1), Natural Resources Energy and Science Authority.

### **GL 316 Remote Sensing and GIS (2 credits)**

Fundamental characteristics of electromagnetic radiation and the interaction of radiation with matter. Concepts of spectral resolution and detection. Remote sensing platforms. Active and passive sensing systems. Visual-digital interpretation. Application in remote sensing in geology. Resource Exploration. Land use and land pattern analysis. Environmental and natural hazards.

Introduction to GIS, Overview, History and Concepts of GIS, Scope and Application Areas, Purpose and Benefits of GIS, Functional Elements of GIS, Mapping Concept – Map elements, Map scales and representation Map Projection, Geometric Rectification, Data Structure – Raster and Vector Data Structure, Data Acquisition, digitization. Laboratory works with the GIS programs (e.g. Arcview and Arc-Info)

Recommended Texts :

1. Gupta, R.P. (2002) *Remote Sensing Geology*, 2<sup>nd</sup> Ed., Springer, 455 pp.
2. P.A. Burrough and R.A. McDonnell (1998). *Principles of Geographical Information Systems*, Oxford University Press.
3. R. A. Schowengerdi,(1983), *Techniques for Image Processing and Classification in Remote Sensing*, Academic Press.

### **GL 317 Sedimentology (3 credits)**

(Prerequisites: GL 201, GL 205)

Facies and their distribution. Sand and sandstone. Provenance and distribution. Deltaic environment- ancient and modern examples. Glacial environment- geomorphology and grain characteristics, ancient and modern examples. Desert environment - erosion, sedimentary processes- ancient and modern examples. Coastal environment- definition - classification, geomorphology- ancient and modern examples. Continental Margin-geomorphology, shallow and deep sediments-ancient and modern examples. Gem sediments- sedimentology and mineralogy. Laterite and bauxite-mineralogy and models of formation. Landslides-causes, signals and preventive measures.

Recommended texts:

1. Sedimentary Petrology by M.E.Tucker, Blackwell 1996
2. Carbonate Sedimentology by M.E.Tucker and V.P.Wright Blackwell 1992
3. The Geology of Fluvial Deposits by A.D.Miall Springer 1996
4. Sedimentary Rocks by F.J. Pettijohn, Harper & Row, New York 1975
5. Sedimentary Environments and Facies by H.G. Reading, Elsevier, New York 1978

### **GL 318 Advanced Field Geology (2 credits)**

Advanced geological and structural mapping at regional scale. Two weeks field excursions. Field mapping of Highland Complex of Sri Lanka, involving intensive field component, and utilizing aerial photographs and GIS techniques.

Recommended texts:

1. Passchier, C.W., Myer, C.W. and Kröner, A (1990). *Field geology of high-grade gneiss terrains*, Springer Verlag, Heidelberg, 150pp.
2. Compton, Robert R. (1985) *Geology in the field*, John Wiley & Sons, NY, 378pp.
3. Mosely, F. (1981). *Methods in field geology*, W.H. Freeman & Co. Publ., California, 211pp.