Geological engineering syllabus

Geological engineering examinations

Group A - Compulsory examinations (seven required)

18-Geol-A1 Mineralogy and Petrology

Introduction to crystallography and crystal chemistry. Physical and chemical properties of minerals in hand specimens. Identification of minerals and rocks with the petrographic microscope. Field and laboratory classification of igneous and metamorphic rocks. The nature of magmas and processes of magmatic differentiation. Metamorphic facies concepts. Interpretation of mineral assemblages of igneous and metamorphic rocks in the light of the phase rule and phase relations of relevant mineral assemblages. Textural and physical properties of rocks relevant to engineering problems.

Textbooks (most recent edition is recommended):


18-Geol-A2 Hydrogeology


Textbooks (most recent edition is recommended):


18-Geol-A3 Sedimentation and Stratigraphy


Textbooks (most recent edition is recommended):


18-Geol-A4 Structural Geology

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18-Geol-A5 Rock Mechanics


Textbooks (most recent edition is recommended):


18-Geol-A6 Soil Mechanics


Textbooks (most recent edition is recommended):


18-Geol-A7 Applied Geophysics

Basic principles, interpretation, and limitations of geophysical methods applied to the exploration for coal, oil and natural gas, minerals, groundwater, and for geotechnical studies of the surface and subsurface. Introduction to electrical, electromagnetic, and magnetotelluric surveys; magnetic and gravity surveys; seismic reflection and refraction surveys; radiometric methods. Introduction to geophysical well logging techniques. Case histories of applications to engineering problems.

Textbooks (most recent edition is recommended):


Group B - Optional examinations (three required)

18-Geol-B1 Contaminant Hydrogeology

Groundwater geochemistry, isotopes in groundwater. Movement of dissolved species. Diffusion and dispersion regimes. Classification of contaminants. Organic contaminants, introduction to multiphase flow, LNAPLs and DNAPLs. Assessment,
control and remediation of contaminants. Waste management. Deep well disposal.

**Textbooks (most recent edition is recommended):**


**18-Geol-B2 Terrain Analysis**


**Textbooks (most recent edition is recommended):**


Required Materials for Examination:


**18-Geol-B3 Site Investigation**

Uses and sources of geological and geotechnical information. Methods of site investigation: trial pits, boreholes, sampling, laboratory and in-situ testing, geophysical methods. In-situ instrumentation and post construction monitoring: measurement of stress, deformation and settlement, pore pressures, permeability, groundwater contamination. Design of site investigations and monitoring schemes.

**Textbooks (most recent edition is recommended):**


**18-Geol-B4 Geomorphology and Pleistocene Geology**


**Textbooks (most recent edition is recommended):**


**18-Geol-B5 Environmental Geology**

Textbooks (most recent edition is recommended):


### 18-Geol-B6 Resource Geology (Select ONE from)

#### 18-Geol-B6-1 Petroleum Deposits

Physical properties, geochemistry, origin, migration, accumulation, and history of oil and natural gas, and their associated waters. Geological conditions of oil and gas entrapment. Structural and stratigraphic factors controlling the distribution of reservoir rocks, porosity, permeability and fluid saturations. Environmental problems associated with the development of hydrocarbons.

Textbooks (most recent edition is recommended):


#### 18-Geol-B6-2 Coal Deposits


Textbooks (most recent edition is recommended):

- No Referenced Textbooks

#### 18-Geol-B6-3 Metallic and Industrial Mineral Deposits

Nature, mode of occurrence and processes of formation of metallic and industrial minerals including minerals deposited from magmas, high-temperature vapours and aqueous solutions; formed by evaporation or precipitation in surface waters; formed by mechanical accumulation or accumulated by residual weathering. Processes of element/mineral migration and concentration. Stratigraphic and structural controls on occurrence. Solution geochemistry and isotopic characteristics of ore bearing fluids and ore deposits. Illustrative case histories for important deposits of sulphides, oxides, native elements, silicates, and ionic salts.

Textbooks (most recent edition is recommended):


#### 18-Geol-B7 Petroleum Development

matching and numerical simulators. Conventional and geostatistical methods of oil and gas reserve estimation.

Textbooks (most recent edition is recommended):

18-Geol-B8 Resource Economics & Valuation


Textbooks (most recent edition is recommended):

18-Geol-B9 Exploration & Mining Geology


Textbooks (most recent edition is recommended):

18-Geol-B10 Geophysical Exploration Methods (Select ONE from)

18-Geol-B10-1 Gravity and Magnetic Fields

Theory and quantitative interpretation of the gravity and magnetic fields in geophysical exploration. Interpretation of regional gravity and magnetic maps. Identification of local anomalies. Data acquisition and data reduction for gravimeters and magnetometers. Design and conduct of field surveys. Potential field, Fourier, forward modeling and inversion methods in data interpretation and analysis.

Textbooks (most recent edition is recommended):

18-Geol-B10-2 Electrical Methods

Textbooks (most recent edition is recommended):


**18-Geol-B10-3 Exploration Seismology**


Textbooks (most recent edition is recommended):