ENGINEERING GEOLOGY II

CE 152

Lecture : 2 **Year : I**
Tutorial : 0 **Part : II**
Practical : 2/2

Course Objectives:
The course will provide the fundamental knowledge of engineering geology to the civil engineering students. Students will be able to measure the geological data from the field, analyze and interpret them for the development of civil infrastructures, for their stability and to provide input design parameters.

1 Hydrogeology (2 hours)

1.1 Basic terminologies: porosity, permeability, hydraulic conductivity, deep and shallow groundwater circulation
1.2 Introduction of aquifer and ground water movement
1.3 Different aquifer system, artificial recharge and springshed management in the Nepal Himalaya

2 Rock properties and Laboratory tests (4 hours)

2.1 Definition and importance of rock properties in engineering
2.2 Mechanical properties of rocks: stress-strain behavior, elastic modulus, Poisson's ratio and strength
2.3 Generalized Hoek-Brown failure criterion
2.4 Introduction to laboratory testing: Uniaxial compression test, Brazilian tensile strength test, Triaxial compression test, Point load test, Schmidt hammer test, Direct shear test, slake durability test
2.5 Introduction to In-Situ stress test: Flat-Jack, Bore-hole over coring method, Hydrofracturing

3 Rock mass classification (4 hours)

3.1 Introduction to rock mass
3.2 Discontinuity characters
3.3 Rock mass classification systems and their importance in civil engineering
3.4 Rock Mass Rating (RMR), NGI-Q system, and geological strength index (GSI)

4 Geological hazards (6 hours)

4.1 Definition; Hazard, Vulnerability and Risk
4.2 Introduction of major geological hazards and their effect on development of earth surfaces
4.3 Landslides: Definition, classification, causes and mitigative measures
4.4 Earthquakes and seismicity: Definition, measurement, causes and effects
4.5 Erosion, Flood, Landslide Dam Outburst Flood and Glacial Lake Outburst Flood (GLOF)

5 Engineering geology for site selection and construction (10 hours)

5.1 Aims and methods of engineering geological site investigation
5.2 Study of topographic, geological, and engineering geological maps, satellite imagery, and Synthetic-Aperture Radar (SAR) image
5.3 Introduction to Geophysical investigation: Electrical Resistivity Tomography (ERT), Seismic Refraction Tomography (SRT), Multichannel Analysis of Surface Waves (MASW), Microtremor Array Measurement (MAM)
5.4 Geological investigation for dam, reservoir, road, canal, bridges, and underground excavation.
5.5 Introduction of borehole, core drilling, core logging, sampling, and bore hole problems
5.6 Tunneling in rock: Methods, geological considerations, and tunnel mapping

6 Rock slope engineering (4 hours)

6.1 Stereographic projection: Plotting a line and planes, representative joint set, rosette diagram
6.2 Kinematic analysis of rock slope and modes of failure (Plane, Wedge, Toppling)
6.3 Rock slope stabilization measures

Practical (15 hours)

1. Study of engineering geological maps: preparation and interpretation
2. Study of relationship between true dip and apparent dip.
3. Study of borehole problems and calculation of bedrock thickness
4. Study and analysis of discontinuities data for failure mechanism by stereographic projection
5. Study of mineral distribution in sand using binocular microscope
6. Presentation of geological data using joint rosette diagram.
7. Interpretation of geophysical investigation data

Field works (2 days)

A two-days fieldwork to provide practical on-site knowledge of engineering geology in any one of the road/highway projects under construction or have severe geo-hazard problem/any one of the hydropower projects under construction. Students submit report after the fieldwork (**Attendance in Fieldwork is Compulsory**).

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks distribution*
1	2	2
2	4	4
3	4	4
4	6	6
5	10	10
6	4	4
Total	**30**	**30**

* There may be minor deviation in marks distribution.

Reference

1. Evert, H., (2006). *Practical Rock Engineering*, 341p.
2. Nilsen, B. and Palmstrom, A. (2000). Engineering Geology and Rock Engineering, Norwegian Group of Rock Mechanics (NBG), 250p
3. Price, D. (2009). Engineering Geology- Principles and Practice. (M. H. de Freitas, Ed.) Springer.Hoek, E., and Brown, E.T. (2019). The Hoek-Brown failure criterion and GSI-2018 edition, Journal of Rock Mechanics and Geotechnical Engineering, 11, 445-463.
4. Vallejo, L.G.de., Ferrer, M., 2011. Geological Engineering, Routledge, Taylor and Francis Group,
5. Hoek, E., Carranza-Torres, C., and Corkum, B. (2002). Hoek-Brown failure criterion-2002 edition, Proc. NARMS-TAC conference, Toronto, 1, 267-273
6. Todd, D.K and Mays, L.W. (2205). Groundwater Hydrology, John Wiley and Sons Inc. 652p.
7. Krynine, D., & Judd, W. R. (2005). Principles of Engineering Geology and Geotechnics. CBS Publishers.
8. Deoja, B., Dhital, M., Wagner, A., & K.B, T. (1991). Mountain Risk Engineering Handbooks I and II. ICIMOD.
9. Dhital, M.R. (2015), Geology of the Nepal Himalaya, Springer International Published, Switzerland.