Marwadi University

Bachelor of Technology

Civil Engineering

Basics of Geology & Geotechnical Engineering

01CI1403

Objective of the Course

- To understand the fundamentals of rock formation and its mineral content.
- Identification of minerals, rocks and classification of rock.
- Knowledge of the engineering properties of the rocks.
- Understand the Importance of geological investigations for engineering projects.
- To acquire knowledge of soil formation and its index properties.
- Ability to classify soils and to evaluate soil parameters such as soil consistency, permeability, etc. experimentally.

Credits Earned: 4

Students Learning Outcomes

After successful completion of the course, it is expected that student will be able to,

1. Describe the formation of rocks and soils and classify them according to Indian standards.
2. Analyze the processes and mechanisms that result in geological formations and hazards.
3. Identify and describe the physical properties of minerals, major rock-forming minerals, and various rock types through simple field testing and observations.
4. Determine soil index properties and understand soil-water interactions.
5. Analyze geological structures and their engineering considerations.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE (I)	Viva (V)	Term Work (TW)	
03	00	02	04	50	30	20	25	25	150

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Detailed Syllabus

Sr No.	Title of the unit	Number of hours
1	**Physical Geology:**	07
	Branches and scope of Geology; Surface processes and landforms	
	Weathering and Erosion; Introduction to geological agents (river, wind, oceans, glaciers, groundwater) and their actions (erosion, transport and deposition) Geological cycle	
	Interior of the Earth: internal structure of earth, the study of core, mental, and crust of the Earth.	
	Plate Tectonics: Introduction to the concept of plate tectonics, the mechanism responsible for plate movement, types of plate boundaries, processes and features associated with plate boundaries. Continental drift and sea floor spreading.	
	seismic hazard: Processes responsible for volcanism, earthquake, Tsunamis and liquefaction	
2	**Mineralogy and Petrology**	07
	Physical properties of minerals, major rock-forming minerals, occurrence and use of minerals	
	Introduction to major rock types (igneous, sedimentary and metamorphic rocks) Their genesis, classification and structures	
	Engineering properties of rocks, advantages, and disadvantages of different rock types at constructions sites	
3	**Structural Geology**	06
	Introduction to primary and secondary geological structures.	
	Study of geological faults, folds, joints and active faulting. Their origin, types and engineering consideration.	
	Geological mapping: study of Strike and dip using models, Introduction to GIS & Remote sensing for geological mapping	
4	**Introduction to Geotechnical engineering**	04
	Definition, brief history, the scope of geotechnical engineering	
	Soil formation and its agencies, soil types based on its formation (residual, transported, alluvial, marine and lacustrine, glacial drift, loess and colluvial soils)	
	General characteristics of different types of soils and overview of different types of soils in Gujarat / India.	
5	**Soil Index Properties and interrelationships**	07
	Three Phase diagram of soil	
	Basic terms and definitions	
	Functional relationships	
	Determination of index properties	
	Relative density for granular soil	

6	**Soil Classification**	**08**
	Objectives, Basis of soil classification:1) by size Particle Size Distribution in soil by sieve analysis (Particle size distribution curve and its uses.) and sedimentation. 2) by Plasticity characteristics: consistency limits (liquid, plastic and shrinkage limits and various indices) Activity, Sensitivity & Thixotropy of soil.	
	brief ofTextural and Unified soil classification. Details of IS classification method,	
	Field identification and General characteristics of the soil.	
7	**Soil Structure& Soil Water**	**03**
	Shape of the particles, Texture and structure of the soil	
	Types of the structure, properties, conditions for the formation of different structures.	
	Free water and held water, Structural water and absorbed water, Capillary	
	Total	**42**

List of Practicals

1. Study of physical properties of major rock forming minerals.
2. Classification of the rocks based on visual observation
3. Specific Gravity of soil
4. In-situ Density-Core Cutter
5. Sieve Analysis – Dry and Wet
6. Liquid and Plastic Limit Test
7. Locating strike and dip of the rock
8. Compressive strength of rock specimen
9. Shrinkage Limit of soil test
10. In-situ Density of soil - Sand replacement
11. Hydrometer test for fine grain soil classification
12. Field Identification of Soil – Dry Strength Test
13. Field Identification of Soil – Dilatancy Test
14. Field Identification of Soil – Toughness Test

Suggested Theory Distribution

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
15%	35%	25%	20%	5%	-

Instructional Method and Pedagogy

1. Prerequisite of the course and its pattern shall be discussed on the commencement of the course.
2. Lectures shall be conducted in class room using various teaching aids.
3. Presence in all academic sessions is mandatory which shall carry 5% marks of the total internal evaluation.
4. At the end of each unit/topic an assignment based on the course content shall be given to the students which shall carry 5% weightage for timely completion and submission of the assigned work.
5. The laboratory experiments are planned in such a way that it covers the practical aspects of the course contents. The performance of these experiments shall bring the clarity of the theoretical concepts which the students have studied during the academic sessions.

Recommended Study Material

Text Books:

1. Engineering and General Geology by Parbin Singh, S. K. Kataria& Sons 2010.
2. Soil Mechanics & Foundations by Punmia B. C.,Laxmi Publications.

Reference Books:

1. Principles of Geotechnical Engineering by Das Braja M, Thomson Asia Pvt. Ltd.
2. Soil Mechanics & Foundation Engineering by Arora K. R., Standard Publications.
3. Soil Mechanics & Foundation Engineering by Alamsingh, CBS Publishers & Distributors, Delhi
4. Structural Geology of Rocks and Regions by G. H. Davis, Stephen J. Reynolds and Charles F. Kluth, 3rd Edition, Wiley 2012.