

COURSE-PLAN

School of Engineering
Department of Civil Engineering
Course Code: 228, Credit: 2
Course Name: Engineering Geology

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1. ABSTRACT

CE228 is the introductory course in Civil Engineering at Tezpur University. The primary purpose of this course is aimed at providing basic understanding of geological science to engineering practice for the purpose of assuring that the geologic factors affecting the location, design, construction, operation and maintenance of engineering works are recognized and adequately provided for.

2. OBJECTIVE

The main objectives of this course in the Department of Civil Engineering at Tezpur University are –

- To study and identify the different types of natural materials like minerals, rocks & soil and know their physical properties.
- To understand the various natural dynamic processes and their influence on the superficial features, natural material and their consequences.
- To understand the geological factors that may influence the location, design, construction, operation and maintenance of Civil Engineering Projects.

3. PREREQUISITES OF THE COURSE: None**4. COURSE SYLLABUS**

Introduction – Introduction to Geology and Engineering Geology, Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Physical properties of minerals, susceptibility of minerals to alteration, basic of optical mineralogy. Rock forming minerals, megascopic identification of common primary & secondary minerals.

Physical Geology- Weathering. Erosion and Denudation. Factors affecting weathering and product of weathering. Geological work of rivers, Wind and Glaciers. Superficial deposits and its geotechnical importance: River valley, Water fall and Stream terraces, River meandering, Alluvium, Glacial striations, Desert Landform, Loess, Residual deposits of Clay with flints, Glacial Valley, Hanging Valley & Cirques, Glacial deposits.

Petrology: Introduction, Rock cycle and study of the following Rocks.

Igneous Rocks- Definition, origin, classification, and forms of Igneous Rocks on the basis of depth of formation. Texture structure, Petrological description and Engineering importance of the following rocks: Acidic Igneous- Granite, Diorite, Gabbro, Pegmatite, and Basic Igneous- Basalt, Dolerite, Dunite, Porphyries.

Sedimentary Rocks- Definition, mode of formation, Mineralogical Composition. Texture and its types, Structures, Gradation of Clastic rocks. Classification of sedimentary rocks and their characteristics. Petrological description and engineering importance of the following sedimentary Rocks- Conglomerate, Breccia, Sandstone, Mudstone, and Shale, Limestone.

Metamorphic Rocks- Definition, Agents & types of Metamorphism, metamorphic grades, Mineralogical composition, structures & textures in metamorphic rocks. Petrological, description and Engineering importance of the following metamorphic rocks- Slate, Schist, Gneiss, Quartzite, and Marble.

Structural Geology (Rock Mechanics) - Introduction, Stress and Strain in rocks. Concept of rock deformations & tectonics. Outcrop, Dip and Strike, and Compass clinometers. Study of structural features of rocks. Main types of discontinuities according to size. Fold- Types and nomenclature, Criteria for their recognition in field. Faults: Classification, recognition in field, effects on outcrops. Joints & Unconformity; Types, Stresses responsible, geotechnical importance. Importance of structural elements in engineering operations. Consequences of failure as land sliding.

Geodynamics- Dynamic activities of the Earth, Plate tectonics. Earthquakes- seismic waves, Magnitude and intensity of earthquake, seismic zones in India, causes and effects, Revelation from Seismic Records of structure of earth. Case Study on Elevation and Subsidence in Himalayan region in India.

Hydrogeology- Introduction, Study of Groundwater and its importance, Occurrence of groundwater in different Geological rock formation, Water table, Water level fluctuation. Types of Aquifers- Confined and unconfined Aquifers, Artificial recharge of ground water. Lowering of water table and Subsidence.

Geophysical Investigation- Introduction, different technique of geophysical exploration. Geophysical Methods of Groundwater exploration and Applications of Electric resistivity method, seismic reflection/refraction method.

Applied Geology- Geological Hazards- Rock Instability and Slope movement. Different controlling factors. Instability in vertical rock structures and measures to prevent collapse. Types of landslides. Prevention by surface drainage, slope reinforcement by Rock bolting and Rock anchoring, retaining wall, Slope treatment. Geology of dam and reservoir site- Required geological consideration for selecting dam and reservoir site. Failure of Reservoir. Favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions, significance of discontinuities on the dam site and treatment giving to such structures, selection of sites for tunnels & bridges.

5. COURSE OUTLINE AND TENTATIVE SCHEDULE

Introduction:	4 Lectures
1. Introduction to geology & Engineering Geology	
2. Mineralogy	
Physical geology:	5 Lectures
1. Weathering	
2. Geological action of wind, running water & glacier.	
Petrology/Study of Rocks:	4 Lectures
1. Rocks & their classification, texture & structure	
Structural Geology:	3 Lectures
Geodynamics:	3 Lectures
1. Introduction, Classification of earthquakes.	
Hydrogeology:	2 Lectures
Geophysical Investigation:	2 Lectures
Applied Geology:	3 Lectures
Total	26 Lectures

6. TEXT BOOKS

1. TB1 Text Book of Engineering Geology, N. Chenna Kesavulu, 2nd Edition (2009), Macmillan Publishers India.
2. TB2: Element of Mineralogy in Engineering Geology by Read, H. H. Rutley's, CBS Publisher.

7. REFERENCE BOOKS

1. RB1: Principles of Engineering Geology by Johnston. R. B. and DeGraff. J. V., John Wiley and Sons, New York.
2. RB2: Fundamental of Engineering Geology by Waltham, T., Spon Press, London.
3. RB3: A Textbook of Engineering and general Geology by Singh. P., S. K. Kataria and Sons, New Delhi.
4. RB4: A Textbook of Geology by Mukherjee P. K., Te world press Pvt. Ltd., Kolkata.
5. RB5: Engineering Geology by D V Reddy, Vikash Publishing House Pvt. Ltd.
6. RB6: Experiments in Engineering Geology by Gokhale, K. V. G. K. and Roa, D. M., Tata McGraw Hill.
7. RB7: A Text Book on Mineralogy by Dana, E.S. (Willey Eastern Limited, 1985)

8. GRADING POLICY:

The assessment is based on revised guidelines on continuous evaluation with relative grading. The break-up of the scheme is as follows,

Sl.	Mode of assessment	Type	Marks	Duration
1	Test I	Objective/subjective	25	45 minutes
2	Test II (Mid-Semester)	Objective & subjective	40	1 hour
3	Test III	Objective/subjective/ Assignment	25	-
4	Test IV (End-Semester)	Objective & Descriptive	60	3 hours
Grand total			150	

9. COURSE OUTCOME

On completion of the course, students will be able to:

COs	COURSE OUTCOMES (COs)	BLOOM'S TAXONOMY
CO1	Understand the geological processes, geological structures and their impact in civil engineering structure.	Understand Apply
CO2	Identify and classify minerals, rocks and suitable sites for civil engineering projects	Analyze
CO3	Understand the natural dynamic processes, lithological characters and related groundwater conditions and their impact on civil engineering projects.	Understand Apply

CO4	Analyze and interpret geological reports and suggests the suitable site for the Civil Engineering project by providing remedial measures.	Analyze Understand Apply
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10. Programme Outcomes (PO) of the B. Tech. programme

Sl. No.	POs
1	Apply knowledge of science, mathematics and engineering principles to analyse and solve problems of civil engineering.
2	Identify, formulate, review literature and analyse the complex civil engineering problems using the principles of mathematics, natural science and engineering sciences.
3	Design and develop the components or a complete civil engineering system within realistic constraints such as public health and safety, cultural, societal and environmental considerations.
4	Design and conduct experiments with research-based knowledge; and thereby analyse and interpret the results from the observations to provide valid conclusions.
5	Select and apply the latest state-of-the-art tools and techniques in civil engineering to model and predict the complex activities and understand its limitations.
6	Apply the information from contextual knowledge to assess societal, health, safety, legal and cultural issues and responsibilities relevant to civil engineering problems.
7	Demonstrate the knowledge of, and need for sustainable development in providing the solutions to the civil engineering problems in environment and societal context.
8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the civil engineering practice.
9	Work individually as well as in teams, both as a member and as a leader, across diverse teams with multidisciplinary settings.
10	Develop appropriate skills of written, oral and visual communications to disseminate their works.
11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to his own work, as a member and leader in a team, to manage projects in multidisciplinary environments.
12	Recognize the need for and have the preparation and ability to engage in life-long learning and continuing professional development.

Lecture schedule

Module	Lecture Topic	No. of Lecture	Linkage with	
			CO	PO
M ₁	Introduction: Introduction to Geology and Engineering Geology, Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Physical properties of minerals, susceptibility of minerals to alteration, basic of optical mineralogy. Rock forming minerals, megascopic identification of common primary & secondary minerals.	4	[1], [2], [3]	[1], [2]
M ₂	Physical Geology- Weathering. Erosion and Denudation. Factors affecting weathering and product of weathering. Geological work of rivers, Wind and Glaciers. Superficial deposits and its geotechnical importance: River valley, Water fall and Stream terraces, River meandering, Alluvium, Glacial striations, Desert Landform, Loess, Residual deposits of Clay with flints, Glacial Valley, Hanging Valley & Cirques, Glacial deposits.	5	[1], [4]	[1], [2], [10], [11], [12]
M ₃	Petrology: Introduction, Rock cycle and study of the following Rocks. Igneous Rocks- Definition, origin, classification, and forms of Igneous Rocks on the basis of depth of formation. Texture structure, Petrological description and their engineering importance Sedimentary Rocks- Definition, mode of formation, Mineralogical Composition. Texture and its types, Structures, Gradation of Clastic rocks. Classification of sedimentary rocks and their characteristics. Petrological description and their engineering importance. Metamorphic Rocks- Definition, Agents & types of Metamorphism, metamorphic grades, Mineralogical composition, structures & textures in metamorphic rocks. Petrological, description and their engineering importance.	4	[2], [4]	[1], [2], [3], [10], [11]
M ₄	Structural Geology (Rock Mechanics) - Introduction, Stress and Strain in rocks. Concept of rock deformations & tectonics. Outcrop, Dip and Strike, and Compass clinometers. Study of structural features of rocks. Main types of discontinuities according to size. Fold- Types and nomenclature, Criteria for their recognition in field. Faults:	3	[2], [3], [4]	[1], [2], [3]

	Classification, recognition in field, effects on outcrops. Joints & Unconformity; Types, Stresses responsible, geotechnical importance. Importance of structural elements in engineering operations. Consequences of failure as land sliding.			
M5	Geodynamics- Dynamic activities of the Earth, Plate tectonics. Earthquakes- seismic waves, Magnitude and intensity of earthquake, seismic zones in India, causes and effects, Revelation from Seismic Records of structure of earth. Case Study on Elevation and Subsidence in Himalayan region in India.	3	[3]	[1], [2], [12]
M6	Hydrogeology- Introduction, Study of Groundwater and its importance, Occurrence of groundwater in different Geological rock formation, Water table, Water level fluctuation. Types of Aquifers- Confined and unconfined Aquifers, Artificial recharge of ground water. Lowering of water table and Subsidence.	2	[3]	[1], [2], [12]
M7	Geophysical Investigation- Introduction, different technique of geophysical exploration. Geophysical Methods of Groundwater exploration and Applications of Electric resistivity method, seismic reflection/refraction method.	2	[4]	[2], [10], [11]
M8	Applied Geology- Geological Hazards- Rock Instability and Slope movement. Different controlling factors. Instability in vertical rock structures and measures to prevent collapse. Types of landslides. Prevention by surface drainage, slope reinforcement by Rock bolting and Rock anchoring, retaining wall, Slope treatment. Geology of dam and reservoir site- Required geological consideration for selecting dam and reservoir site. Failure of Reservoir. Favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions, significance of discontinuities on the dam site and treatment giving to such structures, selection of sites for tunnels & bridges.	3	[4]	[2], [10], [11]
Total Number of Lectures		26		

Mapping of Cos and POs

COs	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Understand the geological processes, geological structures and their impact in civil engineering structure.	3	2	-	-	-	-	-	-	-	-	1	2	3	2	1
CO2	Identify and classify minerals, rocks and suitable sites for civil engineering projects	2	3	1	-	-	-	-	-	-	-	-	-	3	2	1
CO3	Understand the natural dynamic processes, lithological characters and related groundwater conditions and their impact on civil engineering projects.	3	2	-	-	-	-	-	-	-	-	-	1	2	3	1
C04	Analyze and interpret geological reports and suggests the suitable site for the Civil Engineering project by providing remedial measures.	-	3	-	-	-	-	-	-	-	2	1	-	2	3	1