

Techno India NJR Institute of Technology



Course File

Engineering Geology (3CE4-08)

Session 2022-23

Nishit Jain
(Assistant Professor)
Department of CE

RAJASTHAN TECHNICAL UNIVERSITY, KOTA
SYLLABUS

II Year - III Semester: B.Tech. (Civil Engineering)

3CE4-08: ENGINEERING GEOLOGY

Credit: 2

Max. Marks: 100

(IA:30, ETE:70) 2L+0T+0P

End Term

Exam: 2 Hours

SN	Contents	Hrs.
1	Introduction to objective, scope and outcome of the course.	1
2	General Geology: Branches and Scope of Geology, Types of Weathering & Geological work of natural agencies like River & Wind. Geological Time Scale. Physical Properties of Minerals.	6
3	Petrology: Formation, Texture, Structure and Classification of Igneous, Sedimentary and Metamorphic Rocks. Engineering Properties of Rocks for Building & Road Material. Laboratory and Field & in-situ Test for Site Construction.	6
4	Structural Geology: Causes, Terminology, Classification, Recognition, Effects and Engineering consideration of Fold, Fault, Joints and Unconformities.	5
5	Engineering Geology: Geophysical methods as applied to Civil Engineering for Subsurface Analysis (Electrical and Seismic methods). Terminology, Types and Geological consideration for site selection of Dam & Tunnel.	6
6	Remote Sensing & GIS: Application of Remote Sensing and GIS in Various fields of Civil Engineering.	4
TOTAL		28

Course Overview:

Student will learn basics of engineering geology from this 28 hour course. They will know engineering geology is the application of the geological sciences to engineering projects. Engineering geologists provide geological and geotechnical recommendations, analysis, and design associated with human development and various types of Structure .Geological engineering studies are conducted by a geologist or engineering geologist who is educated, trained and has experience in recognizing and interpreting natural processes ; Understanding how these processes affect human – made structures (and vice versa) and knowledge of ways to mitigate hazards caused by adverse natural or human – made conditions. The engineering geologist’s main objective is to protect life and property from damage caused by different geological

Engineering Geology is the basic requirement for the job role Civil Engineer in the companies like MINING, INDIAN OIL etc.

Course Outcomes:

CO.NO.	Cognitive Level	Course Outcome
1	Comprehension	Define different types of rocks & minerals found on earth.
2	Application	List types of faults and folds in earth crust.
3	Analysis	State the difference between several minerals by examining their physical & chemical properties.
4	Synthesis	Understand the remote sensing process and application in various fields of civil engineering.
5	Evaluation	Analyse Engineering consideration of faults, fold, joints and unconformities, Dip and strike.

Prerequisites:

1. Explain different types of rocks & minerals found on earth
2. Explain faults and folds in earth crust.
3. Explain the difference between several minerals by examining their physical & chemical properties ascertain safe, stable and economical civil structures.
4. Recognize the fundamentals of the Earth as a planet, earth’s dynamic actions and their importance for civil engineering structures.

Course Outcome Mapping with Program Outcome:

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO237.1	3	1	2	2	1	1	1	1	1	1	1	1	1	1	2
CO237.2	3	1	2	2	1	1	1	1	1	1	1	1	1	1	2
CO237.3	3	1	2	2	1	1	1	1	1	1	1	1	1	1	2
CO237.4	2	1	1	1	2	1	2	1	2	1	1	2	1	1	1
CO237.5	2	1	2	1	1	2	1	1	1	1	1	1	1	1	1
CO237 (AVG)	2.6	1	1.8	1.6	1.2	1.2	1.2	1	1.2	1	1	1.2	1	1	1.6

Course Coverage Module Wise:

Lecture No.	Unit	Topic
1	1	INTRODUCTION: Objective, scope and outcome of the course.
2	1	GENERAL GEOLOGY: internal structure of earth
3	1	Types of weathering, and geological work of river
4	1	Geological work of wind
5	1	Geological time scale
6	1	Physical properties of minerals
7	1	Revision
8	2	PETROLOGY: Formation, texture of igneous rocks
9	2	Classification of Igneous rocks
10	2	Formation and texture of sedimentary rocks
11	2	Classification of sedimentary rocks
12	2	Structure wind classification of metamorphic rocks
13	2	Engineering properties of rocks lab and field test for construction site
14	3	STRUCTURE GEOLOGY: Terminology, classification of folds
15	3	Causes, recognition effect of folds and engineering consideration of folds
16	3	Terminology and classification of faults and dip and strike problem
18	3	Cause, terminology, classification engineering consideration of unconformity
17	3	Terminology, classification of joint, cause, engineering consideration
18	3	Cause, terminology, classification engineering consideration of unconformity
19	4	ENGINEERING GEOLOGY: Geophysical method as application in civil engineering
20	4	Electric method
21	4	Seismic method
22	4	Terminology and type of dams

23	4	Terminology and types of tunnels
24	4	Geological consideration for site selection for tunnel
25	5	REMOTE SENSING AND GIS: introduction of RS and GIS
26	5	Application of RS and GIS in land use
27	5	Application in construction
28	5	Application in Agricultural and irrigation

TEXT/REFERENCE BOOKS

1. Parbin Singh-A Text Book of Engineering & General Geology- S.K.Kataria & Sons.
2. S.K.Garg- Physical & Engineering Geology- Khanna Publishers.
3. Remote Sensing and GIS: B.Bhatta- Oxford Publishers.
4. M.T.Maruthesha Reddy- A Text book of Applied Engineering Geology- New Age International Publisher.

Assessment Methodology:

1. Practical exam in lab where they have to write practical of Subject. (Once in a week)
2. Assignments one from each unit.
3. Midterm subjective paper where they have to write about Subject (Twice during the semester)
4. Final paper at the end of the semester subjective.

Course Level Problems (Test Items):

CO.NO.	Problem description
1	Explain detail scope of geology What is mineralogy Explain in detail Write a note on use of geology in construction Write a short note on use of geology in water resource development Write a note on physical geology
2	Write a note on igneous rock in detail. Write Chemical composition of Igneous rock in detail Explain in detail Sedimentary rock Explain in detail the Texture of Sedimentary rock Write a note Metamorphic rock and process of metamorphosis
3	Explain detail Structural features in detail. Write a note on Fold in detail. Explain in detail Classification of Fold in detail Explain in detail effects of Folds on Engineering projects Write about faulting in rocks in detail
4	Write about Surface investigation in geology Explain in detail Geophysical method of investigation Write a note on Resistivity method of Investigation
	Explain in detail Seismic Method of Investigation Write a note on Tunnels and Dams
5	Explain in detail Remote Sensing Explain in detail GIS Write a note on EMR Write a note on Signatures in detail Explain in detail application of Remote Sensing and GIS in civil Engineering

Teaching and Learning Resources

Unit-wise: Unit-1

Unit-1

Video Tutorials: <https://www.youtube.com/watch?v=aTVDiRtRook>
Theory concepts: <https://web.viu.ca/earle/geol111/notes-1.pdf>
Sample Quiz: <https://www.geeksforgeeks.org/data-structure-gq/stack-gq/>

Unit-2

Petrology

Video Tutorials: <https://www.youtube.com/watch?v=kqBLyfWfmxE>
Theory concepts: <https://web.viu.ca/earle/geol111/notes-4.pdf>
Sample Quiz: <https://www.geeksforgeeks.org/data-structure-gq/queue-gq/>

Unit-3

Structural Geology

Video Tutorials: <https://www.youtube.com/watch?v=EBiLLJAxBuU>
Theory concepts: <https://www.soest.hawaii.edu/martel/Courses/GG303/>
Sample Quiz: <https://quizizz.com/admin/quiz/5908846d159cc1110045422c/structural-geology-quiz-review>

Unit-4

Engineering Geology

Video Tutorials: <https://www.youtube.com/watch?v=aTVDiRtRook>

Theory concepts: https://www.iare.ac.in/sites/default/files/lecture_notes/EG_LECTURE_NOTES.pdf

Sample Quiz: http://redmine.coolbluei.com/cgi-bin/content/view.php?data=engineering_geology_exam_question_with_answer&filetype=pdf&id=5dc6e7fff5195c5214cbc15abb769040

Unit-5

Remote sensing and GIS

Video Tutorials: https://www.youtube.com/watch?v=qGBA_RVM-t0
Theory concepts: <https://lecturenotes.in/subject/572/remote-sensing-and-gis>
Sample Quiz: <https://www.proprofs.com/quiz-school/story.php?title=pp-mjk2mza0oa46qc>

TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR

B. TECH 2nd – YEAR (III SEM.)

Engineering Geology (Subject Code: 3CE4-08)

Assignment 1

1. Write a note on scope of geology in civil engineering
2. Write a note on geological work of winds
3. Write a note on geological work of rivers.
4. What are different physical properties of minerals
5. Explain any 2 field test in details for site selection
6. What are different properties of rocks for road materials
7. Write a note on classification of igneous rocks
8. Write a note on the classification of sedimentary rocks
9. What are the causes & effects of FAULTS, state the importance in civil engineering
10. What are the causes & effects of FOLDS, state the importance in civil engineering

TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR

B. TECH 2nd – YEAR (III SEM.)

Engineering Geology (Subject Code: 3CE4-08)

Assignment 2

1. Write a note on occurrence of joints
2. How are unconformities detected?
3. Write a note on the site selection for a dam.
4. What are the different forces acting on dam? Explain with dig.
5. Write down the criteria for site selection for a tunnel
6. What are the different surveys done before tunneling?
7. Write a note on application of RS in Civil Engineering
8. How does to use RS-GIS for site monitoring?
9. Explain the integration of RS-GIS with CAD
10. How is RS helpful in town planning

MCQ's

1. What is the stage when the bankfull stage is crossed?

- a) Overflow stage
- b) Flood stage
- c) Dead stage
- d) Excess stage

2. The distance water travels in a unit time is _____

- a) Speed
- b) Unit speed
- c) Velocity
- d) Acceleration

3. What is the term defining the capacity of a river to transport the material?

- a) Gradient
- b) Competence
- c) Flow type
- d) Fluvial

4. The term which is a function of cross-sectional area of the channel and flow velocity is

- _____
- a) Gradient
 - b) Competence
 - c) Discharge
 - d) Stream line

5. The mechanical loosening and removal of the material from the rocks due to pressure exerted by the running water is called _____

- a) Gradient
- b) Weathering
- c) Hydraulic action
- d) Cavitation

6. What is the thickness of the crust under the mountainous areas and in particular the Himalayas?

- a) 50-55 km
- b) 60-65 km
- c) 70-75 km
- d) 30-35 km

7. The discontinuity which marks the lower boundary of the crust is _____

- a) Crust-Mantle discontinuity
- b) Oceanic discontinuity
- c) SIAL layer
- d) Mohorovicic discontinuity

8. The granite layer in the crust is also referred to as _____

- a) SIAL
- b) SIMA
- c) SLAM
- d) SILA

9. The branch of geology which deals with the morphology, classification, mechanism and causes of development of these rock structures is called as _____

- a) Rock geology
- b) Structural geology
- c) Basic geology
- d) Lithology

10. Stratification can be seen widely in which of the following rocks?

- a) Igneous rocks
- b) Metamorphic rocks
- c) Sedimentary rocks
- d) Fossil rocks

11. Outcrop is seen on land everywhere on earth.

- a) True
- b) False

12. Most widespread rock on earth is _____

- a) Igneous rock
- b) Sedimentary rock
- c) Metamorphic rock
- d) All are in equal quantities

13. The maximum angle of inclination of a layer of a rock with the horizontal is _____

- a) Dip
- b) Heave angle
- c) Strike
- d) Depth

14. Which of the following about weathering is not true?

- a) It is a natural process
- b) Mechanical disintegration is involved
- c) Chemical decomposition is involved
- d) It is a rapid process

15. The process that is not considered under mechanical weathering is _____

- a) Carbonation
- b) Temperature variation
- c) Unloading
- d) Insolation

16. The underground routes or passages driven through the ground without disturbing overlying soil cover are called _____

- a) Bridges
- b) Passages
- c) Tunnels
- d) Sub-routes

17. Type of tunnels which are excavated to divert the traffic load of whatsoever type from surface to subsurface routes.

- a) Traffic tunnels
- b) Hydropower tunnels
- c) Public utility tunnels
- d) Delivery tunnels

18. Pick the tunnel which is not a sub-group of traffic tunnels.

- a) Railway tunnels
- b) Sewage tunnels
- c) Highway tunnels
- d) Pedestrian tunnels

19. What is responsible for jointing of rocks?

- a) Genesis
- b) Forces acting on the rock
- c) Genesis and various forces acting on the rock
- d) Precipitation

20. Fractures along which there has been no relative displacement is called?

- a) Faults

- b) Joints
- c) Folds
- d) Intrusions

Solution:

1.b, 2.c, 3.b, 4.c, 5.c, 6.c, 7.d, 8.a, 9.b, 10.c, 11.b, 12.b, 13.a, 14.d, 15.a, 16.c, 17.a, 18.b, 19.c, 20.b

Previous Year Question Papers:

TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR

B. TECH 2nd – YEAR (III SEM.) – MT-I

Engineering Geology (Subject Code: 3CE4-08)

Time: 2 Hr

Max. Marks: 70

Note:

1. The paper is divided into 2 parts: Part-A and, Part-B.
2. Part-A contains 10 questions and carries 2 mark each.
3. Part-B contains 5 questions. Each question is having two options and carries 10 marks each.

Part- A (20 Marks)

	Explain the term erosion	CO1
B.	What do you understand by geological time scale	CO1
C.	Define geology & Different branches of geology	CO1
D.	Define Weathering	CO1
E.	Explain the formation of igneous rocks	CO2
F.	Explain the texture of metamorphic rocks	CO2
G.	Write 4 examples of sedimentary rocks	CO2
H.	Name any 2 laboratory test for rocks	CO2
I.	Draw neat sketch for Folds terminologies	CO3
J.	Draw neat sketch for fault terminologies	CO3

Part- B (50 Marks)

1.	Write a note on scope of geology in civil engineering	CO1
	OR	
1.	Write a note on geological work of winds	CO1
2.	Write a note on geological work of rivers.	CO1
	OR	
2.	What are different physical properties of minerals	CO1
3.	Explain any 2 field test in details for site selection	CO2
	OR	
3.	What are different properties of rocks for road materials	CO2

4. Write a note on classification of igneous rocks	CO2
OR	
4. Write a note on the classification of sedimentary rocks	CO2
5. What are the causes & effects of FAULTS, site the importance in civil engineering	CO3
OR	
5. What are the causes & effects of FOLDS, site the importance in civil engineering	CO3

TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR

B. TECH 2nd – YEAR (III SEM)
CIVIL ENGINEERING DEPARTMENT
Engineering Geology (3CE4-08)

Time: 2 Hr

Max. Marks: 70

Note:

The paper is divided into 2 parts: Part-A, Part-B.

Part-A contains 10 questions and carries 2 marks each.

Part-B contains 5 questions. Each question has two options and carries 10 marks each.

PART A : 20 MARKS [WORD LIMIT 25 WORDS]		
a	Define Joints	CO3
b	What is unconformity	CO3
c	What is the objective of Geological investigation?	CO4
d	What are the 2 main sub-groups in which you divide the geological investigation	CO4
e	Explain the electrical method for sub-surface investigation.	CO4
f	What is the purpose of a dam?	CO4
g	Full form of GIS	CO5
h	Full form of RS	CO5
i	What you understand by least cost route alignment, w.r.t. To RS-GIS	CO5
j	How you can use RS to protect the environment?	CO5
PART B : 10 MARKS EACH [WORD LIMIT 200-250]		
1	Write a note on occurrence of joints	CO3
	OR How are unconformities detected?	
2	Write a note on the site selection for a dam.	CO4

	OR	
	What are the different forces acting on dam? Explain with dig.	
	Write down the criteria for site selection for a tunnel	
3	OR	CO4
	What are the different surveys done before tunnelling?	
	Write a note on application of RS in Civil Engineering	
4	OR	CO5
	How does to use RS-GIS for site monitoring?	
	Explain the integration of RS-GIS with CAD	
5	OR	CO5
	How is RS helpful in town planning	

3E1135

Roll No.:

Total No of Pages: 2

3E1135

B. Tech. III - Sem. (Main / Back) Exam., Dec. 2019

PCC Civil Engineering

3CE4-08 Engineering Geology

Time: 2 Hours

Maximum Marks: 80

Instructions to Candidates:

Attempt all five questions from Part A, four questions out of six questions from Part B and two questions out of three from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL

2. NIL

PART - A

(Answer should be given up to 25 words only)

[5×2=10]

All questions are compulsory

Q.1 Define Geology & name various branches of Geology.

Q.2 Write five names of Igneous, Sedimentary & Metamorphic rocks.

Q.3 Define Fold, Fault & Unconformity.

Q.4 Name various Geophysical Methods applied for subsurface analysis.

Q.5 Define Remote Sensing & GIS.

PART – B

(Analytical/Problem solving questions)

[4×10=40]

Attempt any four questions

- Q.1 Write an Essay on Scope of Geology for Civil Engineers.
- Q.2 Describe about identical characteristics of Igneous, Sedimentary & Metamorphic rocks.
- Q.3 Describe various types of Texture and Structures of Sedimentary rocks.
- Q.4 Define Parts of a Fold and Fault with diagram.
- Q.5 Describe various types of Dam and Draw a neat sketch showing various parts of a Dam.
- Q.6 Write a note on application of Remote Sensing in various fields.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions)

[2×15=30]

Attempt any two questions

- Q.1 Describe classification of Folds with diagram.
- Q.2 Write an essay on Geological Investigation of a Dam Site.
- Q.3 Describe various Geophysical Methods applied for subsurface analysis.

3E1212	Roll No. _____	[Total No. of Pages : 2]
	3E1212 B.Tech. III Sem. (Main) Examination, April/May - 2022 Civil Engineering 3CE4-08 Engineering Geology	

Time : 2 Hours

Maximum Marks : 70

Instructions to Candidates:

Attempt all ten questions from Part A. All five questions from Part B and three questions out of Five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

PART - A

(word limit 25)

(10×2=20)

1. Write scopes of Geology in Civil Engineering?
2. Describe unconformity in rocks?
3. Define fracture mineral properties?
4. Explain the term erosion?
5. Discuss about the Geological time scale?
6. Explain the texture of Metamorphic rocks?
7. What are engineering properties of rocks?
8. Differentiate structural geology and engineering geology?
9. What are the types of weathering?
10. Describe the terms fold and fault?

PART - B

(word limit 100)

(5×4=20)

1. Describe the features formed by river erosion?
2. Classify different types of faults?
3. Explain the texture and structure of sedimentary rocks?

4. Describe the seismic method for subsurface analysis?
5. Differentiate the various processes of Metamorphism?

PART - C

(Any three)

(3×10=30)

1. Explain the field and in - situ test for site construction?
2. Discuss the recognition of fold in field also classify folds?
3. Describe the geological consideration for site selection of Dam?
4. Discuss the application of Remote sensing and GIS in various fields of Civil Engineering?
5. Describe the Geophysical methods applied to civil Engineering for subsurface analysis.

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3E1135
B. Tech. III - Sem. (Main) Exam., Dec. - 2018
PCC Civil Engineering
3CE4 - 08 Engineering Geology

Time: 2 Hours

Maximum Marks: 80

Instructions to Candidates:

Attempt all five questions from Part A, four questions out of six questions from Part B and two questions out of three from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

*Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)*

1. NIL

2. NIL

PART - A

(Answer should be given up to 25 words only)

[5×2=10]

All questions are compulsory

- Q.1 Define the term weathering? [2]
- Q.2 What do you understand by the term remote sensing? [2]
- Q.3 What is petrology? [2]
- Q.4 Explain the term river meandering with diagram. [2]
- Q.5 Write in brief about the electromagnetic spectrum. [2]

[3E1135]

Page 1 of 2

[5060]

PART – B

(Analytical/Problem solving questions)

[4×10=40]

Attempt any four questions

- Q.1 Discuss the geological time scale. [10]
- ~~Q.2~~ Define metamorphism and explain the various structure and texture of metamorphic rocks. [10]
- Q.3 What is unconformity? Describe the different types of unconformities, [10]
- Q.4 Write short notes on: [5×2=10]
- (a) Sensors and its types
 - (b) Origin & formation of sedimentary rocks.
- ~~Q.5~~ Discuss the geophysical methods for sub-surface exploration along with its importance in civil engineering. [10]
- ~~Q.6~~ What do you understand by the term GIS and also discuss the various stages of capturing aerial photograph. [10]

PART – C

(Descriptive/Analytical/Problem Solving/Design Question)

[2×15=30]

Attempt any two questions

- Q.1 What is fault? Describe the various types of faults along with neat sketch. [15]
- Q.2 Explain in detail about the seismic methods for sub-surface investigation. [15]
- Q.3 Describe the following: [5×3=15]
- (a) Satellite imagery and aerial photograph
 - (b) Filters and its types
 - (c) Folds and its types
-

