

B.E. CIVIL ENGINEERING THIRD YEAR FIRST SEMESTER EXAM-2025
GEOTECHNICAL ENGINEERING II(HONS.)

PART-I

[Answer All the Questions]

Total = 100

This Part = 50

[Assume any data reasonably wherever necessary]

1. (a) (b) [CO3]	Discuss the terms (i) Intrinsic Friction and (ii) Critical void ratio and (iii) CVR Line in connection with shear strength of granular soil. Derive the Skempton's pore pressure equation in terms of A and B parameters for plane strain condition and also explain their significance. How the equation differs with triaxial condition?	[6+14]															
2. (a) (b) [CO3]	Discuss the stress conditions in soil during consolidation and shearing stage in CD test and explain the Mohr's circle plots for NC and OC clay. The following are the results of four drained, direct shear tests on a normally consolidated clay. Given: • Size of specimen = 60 mm x 60 mm • Height of specimen = 30 mm Draw a graph for the shear stress at failure against the normal stress, and determine the drained angle of friction from the graph. <table border="1"> <thead> <tr> <th>Test No.</th><th>Normal Force (N)</th><th>Shear Force at Failure (N)</th></tr> </thead> <tbody> <tr> <td>1</td><td>200</td><td>155</td></tr> <tr> <td>2</td><td>300</td><td>230</td></tr> <tr> <td>3</td><td>400</td><td>310</td></tr> <tr> <td>4</td><td>500</td><td>385</td></tr> </tbody> </table>	Test No.	Normal Force (N)	Shear Force at Failure (N)	1	200	155	2	300	230	3	400	310	4	500	385	[6+7]
Test No.	Normal Force (N)	Shear Force at Failure (N)															
1	200	155															
2	300	230															
3	400	310															
4	500	385															
3. [CO5]	A uniform surcharge of 96 kN/m² is applied at the ground surface of a soil profile (Fig. 1), as shown in Figure below. Determine the distribution of the excess pore water pressure in the 3-m-thick clay layer after 18 months of load application using numerical method. Also calculate the average degree of consolidation at that time using the above results. Fig. 1	[12]															
4. [CO2]	Write a short note on 'smear effect' of sand drain.	[5]															

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Ref No. Ex/CE/PC/HT/316/2025

B.E. CIVIL ENGINEERING THIRD YEAR
FIRST SEMESTER EXAM 2025
SUBJECT: GEOTECHNICAL ENGINEERING II(HONS.)
 (Name in full)

PAPER ××××

Time: Three hours

Full Marks =100

(50 marks for part I and 50 Marks for part II)

Use a same Answer-Script for each part

Part - II

- Answer any 25 MCQ only from the available 30 MCQs. Each MCQ is carrying 1 mark.
- Some MCQ question may have more than one correct alternative, so examine each alternative of each MCQ before giving your choice of the concerned MCQ.
- Giving all alternatives of any MCQ as your choices as correct answers of the concerned MCQ, will lead to zero marks for the concerned MCQ.
- If anyone attempts more than 25 MCQ, then the first 25 MCQ will be evaluated and considered only and the other extra MCQ will not be evaluated and will not be considered.
- Either Question 31 or Question 32 (apart from the MCQ questions in this part), has to be answered.
- Then Questions 33, 34, 35 and 36 have to be answered. These questions are mandatory.
- Assume reasonable data if it is not supplied.
- Maintain neatness.
- All drawings-must be drawn by pencil.
- All the notations used here for their conventional meanings.
- No code etc. will be needed to answer the questions of this part.

Instructions (with examples) for giving answers to MCQ in this part:

Suppose you have to answer following MCQ in your answer script:

MCQ 1) Name of the present prime minister of the India

- a) Jawaharlal Nehru,
- b) Narendra Modi,
- c) Manmohan Singh,
- d) None of the above.

MCQ 2) Virat Kohli is

- a) Captain of the Indian Cricket team,
- b) Husband of Anuska Sharma,
- c) President of the BCCI,
- d) All of the above.

MCQ 3) Within the last few months

- a) India won T20 world cup,
- b) Biden left himself away from the presidential election,
- c) China attacked India,
- d) All of the above.

.....

Then during giving answer in your answer scripts, you have to give the answers of the above MCQ in the following style only:

Part –II

Answer to MCQ 1) : b) Narendra Modi,

Answer to MCQ 2) : b) Husband of Anuska Sharma,

Answer to MCQ 3) : a) India won T20 world cup,

b) Biden left himself away from the presidential election,

.....

Note:

(A) In MCQ 2, if anyone give alternative "a)" as one of the correct alternative, he/ she is wrong as Virat Kohli was (not "is") Captain of the Indian Cricket team. So, read each word of the alternatives very carefully before giving your answer.

(B) In MCQ 3, if anybody either alternative "a)" or alternative "b)" as the correct alternative, he/ she will get 0.5 marks as there were two correct alternatives.

(C) There is no negative marking for choosing wrong alternative as your choice in any MCQ.

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PAPER ××××

Time: Three hours

Full Marks –100

(50 marks for part I and 50 Marks for part II)

Use a same Answer-Script for each part

Part - II

Group- A

Choose the correct alternative/ alternatives for any 25 MCQ from the following 30 MCQ:

Question	CO	Marks
1) Rock mechanics is focused on (A) Geotechnical engineering (B) Properties of rocks (C) Engineering mechanics (D) All of the above (E) (A) and (B) above	CO1	1
2) Aggregates of mineral grains make up (A) Soils (B) Mineral grains (C) Both (A) and (B) (D) None of the above	CO1	1
3) Geotechnology describes both the science and engineering about the following/s (A) Soil deposits (B) Rock masses (C) Fluids within the soil or rock mass (D) All of the above	CO1	1
4) In general, the weathered zone's thickness is greater in (A) Arid areas (B) Tropical areas (C) Sea shore areas (D) Desert areas	CO1	1
5) A rock that is not weathered is called "fresh" when the weathering grade is (A) weathering grade VI (B) weathering grade I (C) weathering grade III (D) None of the above	CO1	1
6) The in-situ material, which is essentially a "assemblage" of blocks of intact rock material fragmented by fractures, discontinuities, etc., is referred to as: (A) Rock, (B) Rock mass, (C) Rock assemblage, (D) None of the above	CO1	1
7) The geology of rocks at a site is often assessed by executing (A) surface mapping (B) boreholes (C) trenches (D) All of the above	CO1	1
8) Typically, the thickness of the weathered zone in hot, humid climates (A) is equal to the thickness of the weathered zone noticed in arid areas (B) is less to the thickness of the weathered zone noticed in arid areas (C) is more to the thickness of the weathered zone noticed in arid areas (D) A few feet thick	CO1	1
9) ISRM stands for (A) International Society for Rock Mechanics, (B) International Society for Rock Material, (C) International Society for Rock Management,	CO1	1

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PAPER ××××**Time: Three hours****Full Marks =100**

(50 marks for part I and 50 Marks for part II)

Use a same Answer-Script for each part**Part - II**

(D) Both (A) and (B)

- | | | |
|---|-----|---|
| 10) When working with rock masses, there are inherent uncertainties that result from | CO1 | 1 |
| (A) Uncertainties in the material itself | | |
| (B) Uncertainties in data collection and testing | | |
| (C) Uncertainties in model prediction | | |
| (D) All of the above | | |
| (E) (A) and (B) above | | |
| 11) The evaluation of the engineering properties of the rocks entails: | CO1 | 1 |
| (A) Testing samples of intact rock in the laboratory | | |
| (B) Conducting concerned field tests | | |
| (C) Arial photography | | |
| (D) None of the above | | |
| 12) Typically, in order to determine the volume of rock mass, one must go for | CO1 | 1 |
| (A) laboratory tests | | |
| (B) field tests | | |
| (C) arial photogrammetry | | |
| (D) Both (A) and (B) | | |
| 13) Usually, engineers classify rocks based on: | CO1 | 1 |
| (A) How rocks behave in practice | | |
| (B) Genetic point of view relating to the rocks | | |
| (C) Orientation of the rock mass, | | |
| ((D) All of the above | | |
| 14) "For rock excavation, _____ is necessary", the most suitable word to fill up the blank, is | CO1 | 1 |
| (A) boring | | |
| (B) drilling | | |
| (C) blasting | | |
| (D) All of the above | | |
| 15) The following categories of geological processes are possible: | CO1 | 1 |
| (A) mechanical | | |
| (B) hydrological | | |
| (C) thermal | | |
| (D) All of the above | | |
| 16) An intact rock's compressive strength is usually determined by testing of: | CO1 | 1 |
| (A) A cylindrical specimen with slenderness ratio 1 | | |
| (B) A cylindrical specimen with slenderness ratio 2 | | |
| (C) A square specimen with slenderness ratio 1 | | |
| ((D) A square specimen with slenderness ratio 2 | | |
| (E) (B) and (D) above | | |
| 17) "The first treatise on rock mechanics was published in _____, marking the beginning of the field's independence". The appropriate word to fill the blank, is: | CO1 | 1 |
| (A) 1957, | | |
| (B) 1967, | | |
| (C) 1977, | | |
| (D) None of the above | | |
| 18) The way a rock mass reacts to an experiment, is dependent on | CO1 | 1 |
| (A) Presence of liquid within the discontinuities | | |
| (B) Discontinuities | | |
| (C) Intact rock | | |

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(50 marks for part I and 50 Marks for part II)

Use a same Answer-Script for each part

Part - II

(D) All of the above

19) The goals of rock mechanics for the majority of engineering projects involving rocks are basically: CO1 1

- (A) two-fold
- (B) three-fold
- (C) four-fold
- (D) None of the above

20) Rocks themselves can serve as bases for CO1 1

- (A) Construction materials aggregates
- (B) Construction stones
- (C) Generation of coarse sands
- (D) All of the above

21) As civil engineers, we need to know the vertical and lateral extent of CO1 1

- (A) the weathering zone
- (B) the different grades of weathering
- (C) the depth to the fresh un-weathered rock
- (D) All of the above

22) A clear understanding of the difference between a soil and a rock is needed for: CO1 1

- (A) engineering contracts are concerned
- (B) engineering drawings are concerned
- (C) engineering estimates are concerned
- (D) All of the above

23) In order to obtain a universal engineering classification of rocks, classification system must adhere to CO1 1

- (A) Two requirements
- (B) Three requirements
- (C) Four requirements
- (D) None of the above

24) "From a _____ point of view, we should also keep in mind that the engineering properties of a rock mass do change as it weathers". The appropriate word to fill the blank, is: CO1 1

- (A) behavioral
- (B) aesthetic
- (C) mineralogical
- (D) None of the above

25) In Geo-technology related with rock mechanics, one has not to give so much importance on CO1 1

- (A) Fluids within the rock masses
- (B) Nature of rock
- (C) Soil deposits
- (D) Rock masses

26) In respect of _____, communication problem between geologists and engineers exists. The appropriate words to fill the blank, are: CO1 1

- (A) rock orientation
- (B) rock classification
- (C) rock composition
- (D) None of the above

27) Soils are typically the result of CO1 1

- (A) the thermal weathering of rocks

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Use a same Answer-Script for each part
 Part - II

- (B) the chemical weathering of rocks
 (C) the mechanical weathering of rocks
 (D) All of the above
- 28) Rock properties can be: CO1 1
 (A) Temperature dependent,
 (B) Scale-dependent,
 (C) Time-dependent,
 (D) All of the above
 (E) (B) and (C) above
- 29) "The field of rock mechanics has progressed _____ than soil mechanics". The appropriate word to fill the blank, is: CO1 1
 (A) faster,
 (B) slowly,
 (C) parallelly,
 (D) with more predictive mode
- 30) Geological hazards develop from: CO1 1
 (A) Hazards from geological processes
 (B) Hazards from geological materials
 (C) Hazards from geological age
 (D) All of these

Group- B

Answer either question number 31 or question number 32. If anyone answers both 31 and 32, then 31 will be evaluated and considered only and 32 will not be evaluated and will not be considered.

- | | Question | CO | Marks |
|----------|---|-----------|--------------|
| (31) (a) | What are the differences between "rock" and "rock mass"? | CO1 | 3 |
| (31) (b) | Why clear understanding about the difference between rock and soil, is necessary? | CO1 | 2 |
| (32) (a) | Briefly discuss on the historical development of rock mechanics | CO1 | 5 |

Write short notes on any one from question number 33.

- | | | | |
|----------|-------------------------|-----|---|
| (33) (a) | Nature of "rock mass". | CO1 | 5 |
| (33) (b) | What is rock mechanics? | CO1 | 5 |

Answer any two questions from question number 34.

- | | | | |
|----------|--|-----|---|
| (34) (a) | Which type of tests belong to micrographic test of rock? | CO1 | 3 |
| (34) (b) | Which type of tests belong to the tests to determine the physical properties of rock? | CO1 | 3 |
| (34) (b) | Which type of tests belong to the tests to determine the engineering properties of rock? | CO1 | 3 |

Answer any one question from question number 35.

- | | | | |
|-----------|--|-----|---|
| (35) (a). | Which factors influence the compressive strength due to testing procedure? | CO1 | 4 |
| (35) (b) | Draw the two: | CO1 | 4 |
| | a) plastic-elastic- plastic curve for uniaxial compression test adopted in rock. | | |
| | b) elastic- plastic- creep curve for uniaxial compression test adopted in rock. | | |

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Use a same Answer-Script for each part

Part - II

Group- C

Answer question number 36. This is mandatory question.

(36) (a) Write notes on Triaxial test on rock specimen.

CO3 5

End of Questions