

**B.E. CIVIL ENGINEERING THIRD YEAR FIRST SEMESTER
SUPPLEMENTARY EXAM 2024
GEOTECHNICAL ENGINEERING II(HONS.)**

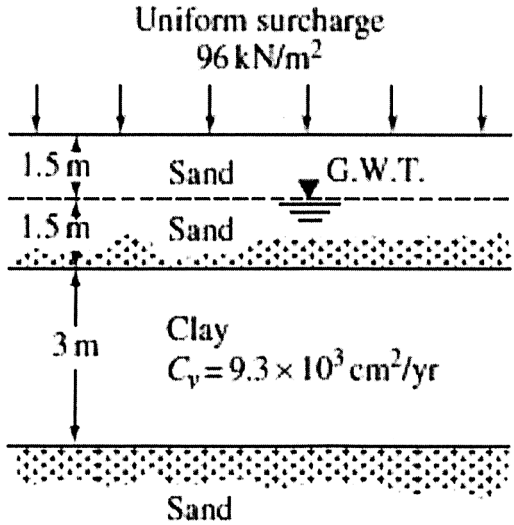
Time : Three hours

(50 Marks for each Part)
Use separate answer script for each Part

Full Marks : 100

PART-I**[Answer All the Questions]**

[Assume any data reasonably wherever necessary]

1. [CO3]	Discuss the typical stress-strain and volume change behaviour of sand for different initial states with neat sketches.	[12]
2. (a) (b) [CO3]	<p>Discuss the stress conditions in soil during consolidation and shearing stage in CD test and also draw and explain the Mohr's circle for NC and OC clay.</p> <p>A consolidated-drained (CD) triaxial test was conducted on a normally consolidated clay. The results are as follows: $\sigma_3 = 120 \text{ kPa}$ $(\Delta\sigma_d)_f = 170 \text{ kPa}$</p> <p>Determine: (i) Angle of internal friction, ϕ' and (ii) Angle θ that the failure plane makes with the major principal plane.</p>	[8+7]
3. [CO5]	<p>A uniform surcharge of 96 kN/m^2 is applied at the ground surface of a soil profile, as shown in Figure below. Determine the distribution of the excess pore water pressure in the 3-m-thick clay layer after 24 months of load application using numerical method. Also calculate the average degree of consolidation at that time using the above results.</p> <p>[Don't take spacing for spatial discretization greater than 1m]</p> <div style="text-align: center;">  <p>The diagram shows a soil profile with a uniform surcharge of 96 kN/m^2 applied at the top. The profile consists of a top sand layer (1.5 m thick), a middle sand layer (1.5 m thick), a central clay layer (3 m thick), and a bottom sand layer. The groundwater table (G.W.T.) is shown at the interface between the two sand layers. The clay layer has a coefficient of consolidation $C_v = 9.3 \times 10^3 \text{ cm}^2/\text{yr}$.</p> </div>	[15]
4. [CO2]	Write a short note on the 'smear effect' of sand drain.	[8]

[Turn over

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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**

- 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 Question 33 has to be answered. This question is 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) Israel attacked Palestine,
- b) IIC World Cup has been started,
- 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) Israel attacked Palestine,

b) IIC World Cup has been started,

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.....
 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.

Group- A

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

Question

- 1) Rock mechanics is concerned with
 (A) Geotechnical engineering
 (B) Properties of rocks
 (C) Engineering mechanics
 (D) All of the above
 (E) (A) and (B) above

CO
CO1 **Marks**
 1

- 2) Soils are aggregates of
 (A) Rock Grains
 (B) Mineral grains
 (C) Rock Grains with water
 (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) The thickness of weathered zone is generally more 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 material in situ which can be seen as an "assemblage" of blocks of intact rock material separated by discontinuities, fractures, etc., are termed as:
 (A) Rock,
 (B) Rock mass.

CO1 1

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(C) Rock assemblage, (D) None of the above		
7) Evaluation of the site geology of rocks are usually done by conducting (A) surface mapping (B) boreholes (C) trenches (D) All of the above	CO1	1
8) In hot and humid areas, generally the thickness of the weathered zone (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, (D) Both (A) and (B)	CO1	1
10) Uncertainties are inherent when dealing with rock masses and such uncertainties are due to (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	CO1	1
11) Assessment of the engineering properties of the rocks involves: (A) Testing samples of intact rock in the laboratory (B) Conducting concerned field tests (C) Arial photography (D) None of the above	CO1	1
12) Model and predict the behaviors of the rock mass are essential when rock mass is: (A) subjected to fast weathering actions (B) subjected to the new loads (C) subjected to water inflow within that (D) None of the above	CO1	1
13) Engineers classify rock generally based on: (A) Genetic point of view relating to the rocks (B) How rocks behave in practice (C) Orientation of the rock mass, ((D) All of the above	CO1	1
14) Geological processes can be (A) mechanical	CO1	1

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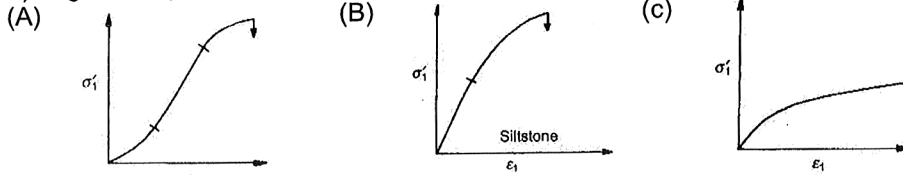
- (B) hydrological
- (C) thermal
- (D) All of the above

15) The compressive strength of an intact rock is usually determined by testing:

- (A) A cylindrical specimen with slenderness ratio 3
- (B) A cylindrical specimen with slenderness ratio 2
- (C) A square specimen with slenderness ratio 3
- (D) A square specimen with slenderness ratio 2
- (E) (B) and (D) above

CO1 1

16) In general, plastic elastic plastic curve is being represented by:



- (D) None of these

CO1 1

17) Rock mechanics has become a separate discipline (with the first treatise) in the year

- (A) 1947,
- (B) 1957,
- (C) 1967,
- (D) None of the above

CO1 1

18) The response of a rock mass to a test depends on

- (A) Intact rock
- (B) Discontinuities
- (C) Presence of liquid within the discontinuities
- (D) All of the above

CO1 1

19) In compressive strength test, the possible likely modes of failure of intact rocks are

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

CO1 1

20) In good rock mass condition, the moduli ratio in the fifth cycle of loading and unloading

- (A) becomes almost 1.6
- (B) becomes almost 1.4
- (C) becomes almost one
- (D) None of the above

CO1 1

21) For Unweathered/unaltered rock, there is:

- (A) No visible signs of alteration in the rock material out and fracture planes may

CO1 1

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be stained or discoloured		
(B) Visible signs of alteration in the rock material out and fracture planes may be stained or discoloured		
(C) No visible signs of alteration in the rock material out and fracture planes may not be stained or discoloured		
(D) None of the above		
22) To get universal engineering classification of rocks, the classification system must meet	CO1	1
(A) Two requirements		
(B) Three requirements		
(C) Four requirements		
(D) None of the above		
23) Rocks can be used in themselves as raw sources for	CO1	1
(A) Construction materials aggregates		
(B) Construction stones		
(C) Generation of coarse sands		
(D) All of the above		
24) Non-uniqueness of the geophysical data is considered as	CO1	1
(A) Limitation		
(B) Advantageous		
(C) Disturbing		
(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 general, rock and rock mass properties cannot be assigned to a design calculation with the same degree of certainty as for other types of engineering materials such as concrete or steel for:	CO1	1
(A) Two reasons		
(B) Three reasons		
(C) Four reasons		
((D) More than four reasons		
27) For rock mass classification, classification system is:	CO1	1
(A) Simple and meaningful in terminology		
(B) Functional for general use in solving the whole variety		
(C) Containing a lot of case histories		
(D) None of the above		
28) Site exploration and investigation is usually conducted in	CO1	1
(A) One step		

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- (B) Two steps
 (C) Several steps
 (D) Search of costly minerals

29) The **ratio of the modulus value of intact rock material to the modulus value of rock mass**, generally lies within the range of:

- (A) 5 to 10
 (B) 5 to 15
 (C) 5 to 20
 (D) 10 to 20

CO1 1

30) Modulus of Deformation is needed mainly due to

- (A) Non elastic behaviour of jointed rock mass
 (B) Non elastic behaviour of intact rock material
 (C) Presence of gouge material in the rock mass
 (D) Probability of presence of pockets in rock mass

CO1 1

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 difference between "rock" and "rock mass"?	CO1	3
(31) (b) What are the fields of applications of rocks?	CO1	6
(31) (c) Explain the reason/s behind the communication problem between geologists and engineers in respect of rock classification.	CO1	6
(d) How rocks can be used either as the construction or the foundation material as the parts of the engineering activities?	CO1	5
(32) (a) "In general, rock and rock mass properties cannot be assigned to a design calculation with the same degree of certainty as for other types of engineering materials such as concrete or steel."- explain the reasons behind this statement.	CO1	6
(32) (b) For most engineering projects involving rocks, what are the objectives of rock mechanics?.	CO1	3
(c) Write short notes on geological hazards.	CO1	5
(d) Describe the historical developments of rock mechanics	CO1	6

Group- C

Answer question number 33. This is mandatory question.

- (33) (a) Write notes on Triaxial test on rock specimen. CO3 5

End of Questions