

EX/CE/T/416B/2017(S)

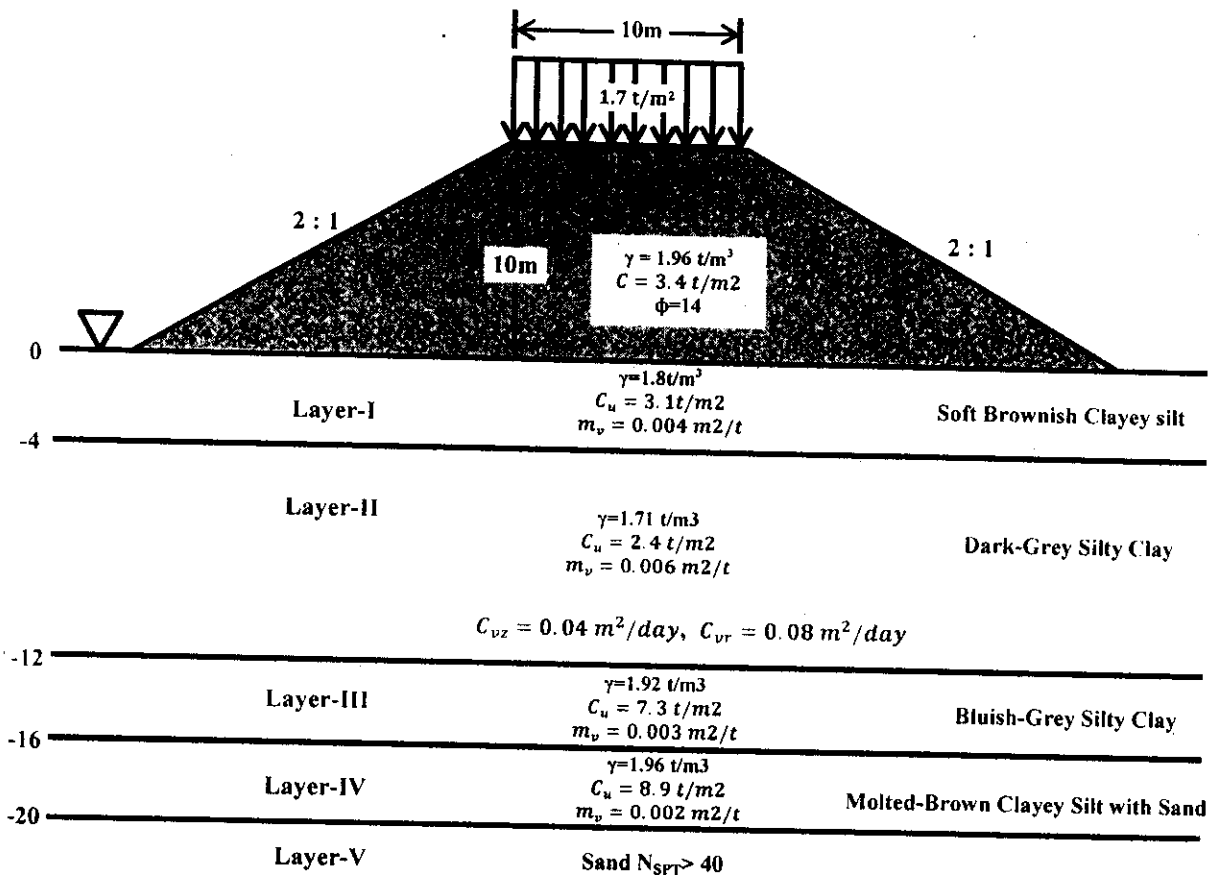
**B. CIVIL ENGG. 4<sup>TH</sup> YEAR 1<sup>ST</sup> SEM. SUPPLEMENTARY EXAM. 2017**  
**GEOTECHNICS OF HIGHWAY ENGG. (ELEC-I)**  
**PART-I**

Time: Three Hours

Full Marks 100  
(50 marks for this part)

Use a separate Answer-Script for each part  
 [Answer all the questions & assume data reasonably wherever necessary]

1. A road embankment is to be constructed near Kolkata city. The details of the embankment and subsurface soil profile is given below:



- (i) Check the bearing capacity of sub-soil. If the sub-soil doesn't possess the required strength propose a suitable method of construction.
  - (ii) Determine the consolidation settlement. Calculate the time required to reach 90% degree of consolidation. Indicate whether the calculated time can be given from construction point of view. If not, propose a suitable ground improvement technique.
  - (iii) Finally, check the stability of the embankment slope using the method of slices. Consider a typical slip circle passing through the interface of first layer and second layer. [ 8+15+12 ]
2. (a) Derive expressions of Factor of Safety (FS) for an infinite slope for (i) only  $\Phi$  and (ii) only c type of soil.  
 (b) Write a short note on "Preloading".  
 (c) What are the parameters generally monitored during the construction of highway embankment? Discuss in brief about the instrumentations to monitor them. [ 5+5+5 ]

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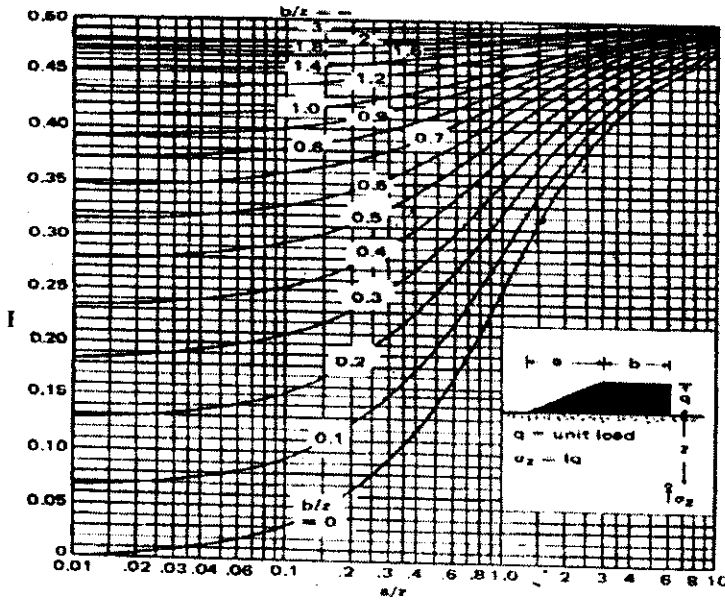
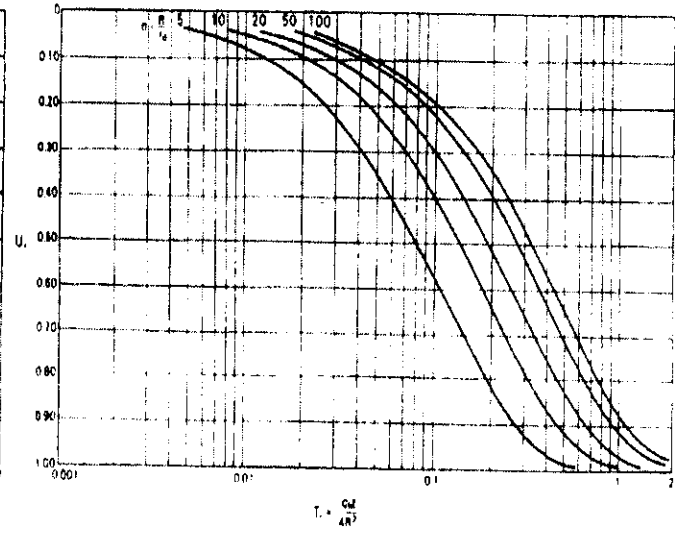
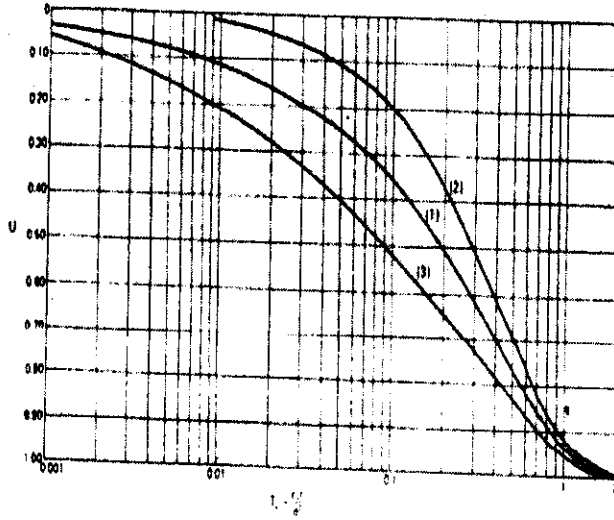
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**Required Graphs**



**B.CIVIL ENGG. 4<sup>th</sup> YEAR 1<sup>st</sup> SEMESTER SUPPLEMENTARY EXAM. 2017**  
 (1st /2nd Semester/Repeat/Supplementary /Spl. Supplementary /Old/Annual/Bi-Annual)  
**SUBJECT: Geotechnics of Highway Engineering**

(Name in full)  
**PAPER xxxx**

Time: ~~Two hours/ Three hours/Four hours/Six hours~~

**Full Marks 30/100**  
 (45/50 marks for each part)

Use a separate Answer-Script for each part

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Part - I/II

No. of  
 Question

Marks

- (1) Do not retain mobile phone (even in switched off condition, too) to avoid RA  
 (2) Maintain neatness. (3) Assume reasonable data if it is not supplied.  
 (4) Answer any two questions. (5) All drawings must be drawn by pencil.  
 (6) No code etc. will be needed to answer the questions of this part

- (1)(a) Why it is essential that aggregate should be thoroughly tested before using for construction? 2  
 (b) Why material selection plays an important role in the construction of embankment? 3  
 (c) What is meant by pavement material? Is the two term 'pavement material' and 'aggregate' synonymous or there is any difference between the two terms? Explain with logic. 2+3=5  
 (d) Design a 7.5 m high grid reinforced retaining structure using a grid with an ultimate tensile strength of 150 kn /m & strength at 5 % strain =65 kn /m overall FS should be 1.4, partial F.S's for the grids should be 4(ultimate tensile failure) and 2 (excessive deformation at 5% strain). Assume free draining backfill with  $\gamma = 17.5 \text{ kn/m}^3$  &  $\phi = 34^\circ$ . The structure should be vertical ( $\beta >= 85^\circ$ ). If the structure cannot be made at  $\beta >= 85^\circ$  slope, how much would have to flatten the slope? 10

OR

Check the internal stability for the following 7.5m high geo-textile reinforced retaining structure : a. The fabric which was used for reinforcement has an ultimate tensile strength of 210 kN/m and strength at 5% strain =72 kN/m.

- b. FS should be 1.5 for reinforcement failure, pullout etc.  
 c. Partial F.S's for the reinforcement should be 4 (ultimate tensile failure) and 2 (excessive deformation at 5% strain).

Backfill is of good quality with  $\gamma = 18.0 \text{ kN/m}^3$  &  $\phi = 34^\circ$ . The structure need to be essentially vertical.

- (e) Write short notes (any two) - a) Reinforcement length, b) Embedment length, c) Vertical spacing of reinforcement, d) stage construction 2\*2.5=5
- (2)(a) Why consideration of "existing pore water pressure" in the "stability calculation of an embankment" is very important? 5  
 (b) Name any five road building machinery. 5  
 (c) Describe (with neat sketches) the possible failure modes of geogrid (or geotextile) reinforced wall. 5  
 (d) Define any four: (a) shape of aggregate, (b) hardness, (c) toughness, (d) durability, (e) strength 4\*2=8  
 (e) What is/are the difference/s between "toughness" and "hardness"? 2

- (3)(a) Write short notes on any one: 5  
 (a) fly ash in soil improvement, (b) fly ash in structural fills / embankments
- (b) Fill in the blank cells in the table (answer in your answer-script): 7

Property of Aggregate	Type of Test for determining the property
Durability	
Adhesion to bitumen	
Shape factors	
Crushing strength	
Toughness	
Specific gravity and porosity	
Hardness	

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 (1st/2nd Semester/Repeat/Supplementary /Spl. Supplementary /Old/Annual/BI-Annual)  
**SUBJECT: Geotechnics of Highway Engineering**

(Name in full)  
**PAPER xxxxx**

Time: ~~Two hours~~ / Three hours / ~~Four hours~~ / ~~Six hours~~

Full Marks **30/100**

(45/50 marks for each part)

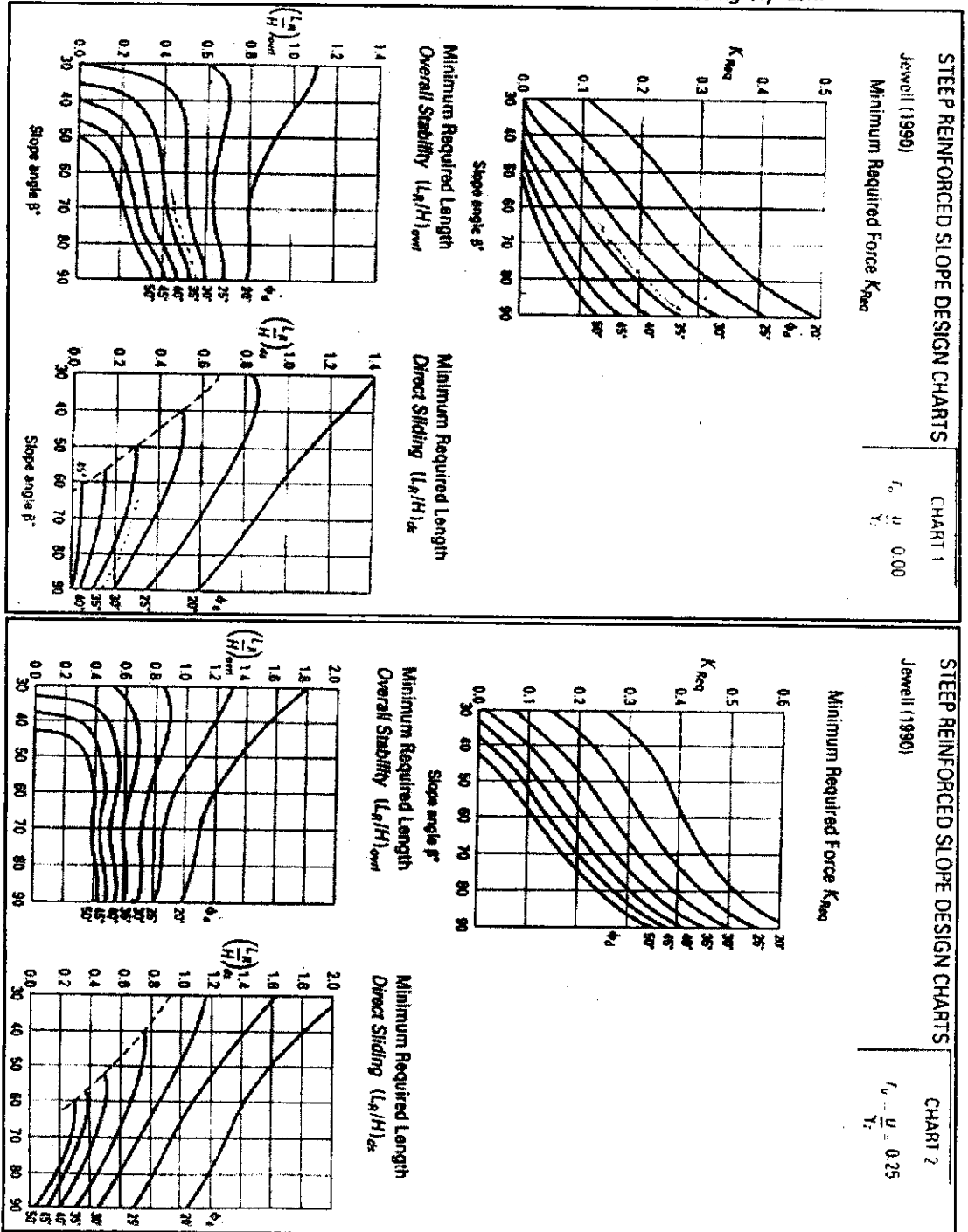
Use a separate Answer-Script for each part

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- (3)(c) Describe the function of any two road building machinery to build the road.  
 (d) What is fly ash? What are the environmental benefits obtained for using fly ash?

2+4=

2+3=



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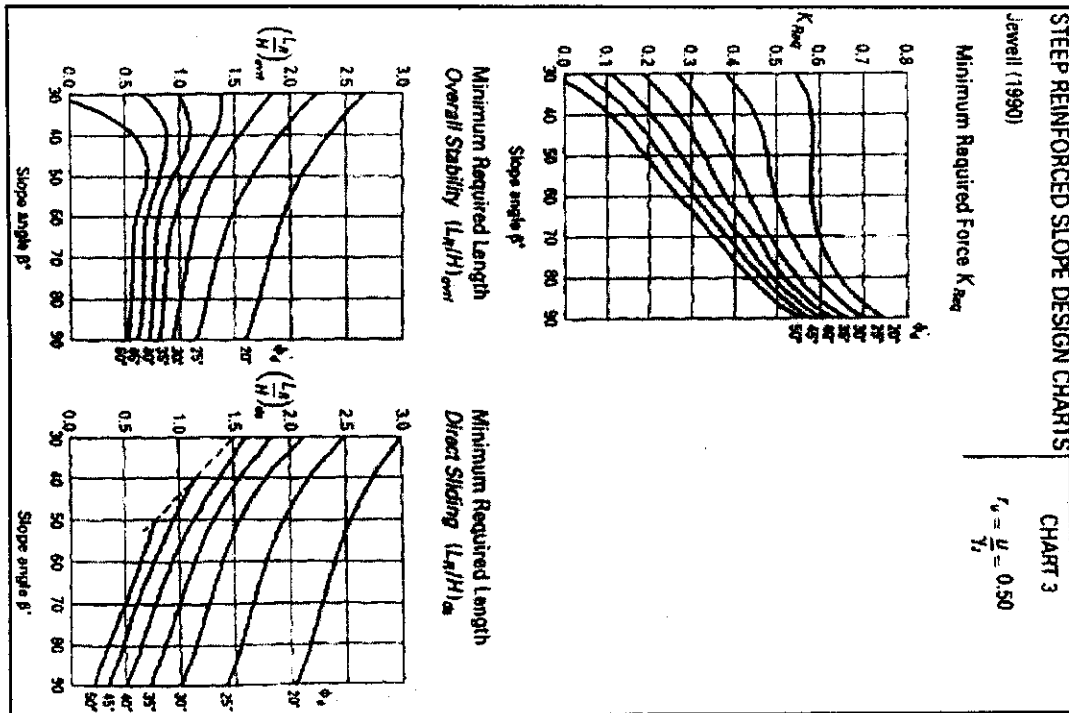
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End of the Part-II of the question