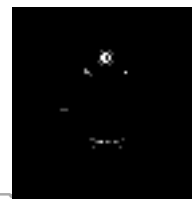


SOIL STABILISATION & GROUND IMPROVEMENT TECHNIQUE (SEMESTER - 8)

CS/B.TECH(CE - NEW)/SEM-8/CE-802/1/09



1.
Signature of Invigilator

2.
Signature of the Officer-in-Charge

Reg. No.

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Roll No. of the
Candidate

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CS/B.TECH(CE - NEW)/SEM-8/CE-802/1/09

ENGINEERING & MANAGEMENT EXAMINATIONS, APRIL – 2009

SOIL STABILISATION & GROUND IMPROVEMENT TECHNIQUE (SEMESTER - 8)

Time : 3 Hours]

[Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
b) For **Groups – B & C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

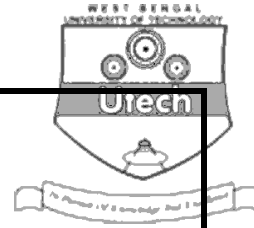
FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

	Group – A										Group – B					Group – C					Total Marks	Examiner's Signature
Question Number																						
Marks Obtained																						

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Head-Examiner/Co-Ordinator/Scrutineer

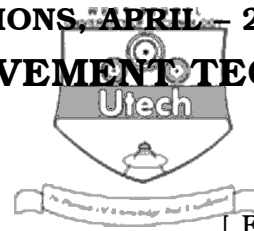
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ENGINEERING & MANAGEMENT EXAMINATIONS, APRIL - 2009
SOIL STABILISATION & GROUND IMPROVEMENT TECHNIQUE
SEMESTER - 8



Time : 3 Hours]

[Full Marks : 70

Assume reasonable value of additional data if required;

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternative for any *ten* of the following : 10 × 1 = 10

i) Vibratory rollers are efficient in compacting

- a) sandy soils
- b) both sandy and clayey soils
- c) clayey soils
- d) silty and clayey soils.

ii) The rollers which are most effective in compacting cohesive soils are

- a) pneumatic rubber tyred rollers
- b) sheep's foot rollers
- c) smooth wheel rollers
- d) vibratory rollers.

iii) The suitability number, S_n for an excellent backfill material is

- | | |
|------------|------------|
| a) 0 – 10 | b) 10 – 20 |
| c) 20 – 30 | d) > 50. |

iv) In situ densification technique for soft clay is

- a) vibration
- b) impact compaction
- c) blasting
- d) accelerated consolidation.

- 11

xiii) The type of grouting having the most diverse applications in soils is

- a) permeation grouting b) displacement grouting
c) jet grouting d) soil fracture grouting.



xiv) To prevent the soil mass getting displaced or fractured, the grouting pressure as a rule of thumb is limited to

- a) 25% of the effective overburden pressure at the depth
b) 35% of the effective overburden pressure at the depth
c) 45% of the effective overburden pressure at the depth
d) 55% of the effective overburden pressure at the depth.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

3 × 5 = 15

2. What is the purpose of soil stabilization ?
3. Why is cement used for stabilization of soil ?
4. What are sand drains ? How are they installed ? How is the average degree of consolidation estimated for use of sand drains ?
1 + 1 + 3
5. Where is vibrofloatation technique applied ? Describe the technique. Determine the suitability number of a backfill of which $D_{50} = 1 \text{ mm}$, $D_{20} = 0.5 \text{ mm}$, $D_{10} = 0.08 \text{ mm}$.
1 + 3 + 1
6. Discuss the behaviour of sand and clay for in situ densification under externally applied loads.
7. Describe the method of in situ densification of sand by compaction piles.
8. Give the advantages and disadvantages of geo-grids for soil reinforcement in comparison to steel strips.

(Long Answer Type Questions)

Answer any *three* questions. $3 \times 15 = 45$

9. During the construction of a highway bridge it is expected that the average permanent load on the clay layer will increase by about 115 kN/m^2 . The average effective overburden pressure at the middle of the clay layer is 210 kN/m^2 . Given $H_c = 6 \text{ m}$, $C_c = 0.28$, $e_o = 0.9$ and $C_v = 0.36 \text{ m}^2/\text{month}$ and taking the clay layer as normally consolidated,
- determine the total primary consolidation settlement of the bridge without pre-compression.
 - determine the time required for 90% consolidation under the additional permanent load only.
 - determine the surcharge that will be required to eliminate by pre-compression the entire primary consolidation settlement in 9 months.
- 15
10. An embankment of 10 m height is to be constructed in a 8 m thick layer of clay overlaying rock. The embankment will increase the mean effective vertical stress in the clay after consolidation from a value of 80 kN/m^2 to 200 kN/m^2 . The embankment to carry a road will be laid in 4 months. The surfacing will be laid 12 months after the commencement of construction. Only 3 cm of settlement can be accepted after the surfacing of the road. Design a suitable sand drain installation to achieve the above requirements. Given $C_v = C_{vr} = 8 \times 10^{-4} \text{ cm}^2/\text{sec}$ and $m_v = 3 \times 10^{-2} \text{ cm}^3/\text{kg}$.
- 15
11. a) What is the meaning of soil stabilization ? 2
- b) How is soil stabilized by using soft aggregates ? 5
- c) It is proposed to construct a sandy clay road conforming to the gradation specification :

IS Sieve	% gradation Limit	Sand material (A)	Silt-clay material (B)
4.75 mm	100	100	—
2.36 mm	80 - 100	91	—
1.18 mm	50 - 80	34	100
425 μ	30 - 60	9	85
300 μ	20 - 45	3	59
75 μ	10 - 25	2	36

Gradation requirements indicate that a ratio 1 : 1 of the two materials would be adequate. L.L. & P.I. of the materials A & B are as under :

	A	B
L.L.	25%	38%
P.I.	2%	10%

What will be the L.L. & P.I. of the mixture ? If the maximum L.L. & P.I. are to be respectively 35% & 9%, what should be the proportion of A & B in the mix ? 8

12. a) What is the application of soil reinforcement ?
 b) Check the reinforced earth wall for stability against
 i) sliding
 ii) overturning and
 iii) bearing failure.

Although *BC* is a rough surface, assume it to be smooth.

Dia.

For flock *ABCD* allowable soil pressure = 250 kN/m^2 . 15

13. a) Draw the flow diagram of reactions in lime-clay-water for lime stabilization. 7
 b) Describe the mechanism of lime soil stabilization. 8
14. Describe the densification of in situ granular soils by impact at ground surface. Determine the effect of compaction in sandy soils if the tamping weight is 20 tonnes and the drop height is 10 m. How is improvement of loose sand determined in impact compaction. Cite some examples of improvement. 9 + 3 + 3



15. a) What quantity of cement is required for permeation grouting in gravel, having void ratio of 0.6, if the grout mix has a water-cement ratio of 6 : 1 ? Assume that the 50% of the void space get filled with the grout slurry. 7
- b) Grouting is to be carried out in 12 m deep grout holes spaced at 3 m distance centre to centre for the above problem 15 (a). What will be the saving per grout hole if 50% cement is replaced by Bentonite, given that the cost of cement is Rs. 500 per KN and that of Bentonite is Rs. 240 per KN. Assume the grout will permeate uniformly around each grout hole and the volume of soil grouted will be a cylinder of diameter 3 m around each grout hole. 8



END