



**NAVVRACHANA
UNIVERSITY**
a UGC recognized University

School: School of Engineering and Technology
Program/s: B.Tech Civil Engineering
Year: 4th **Semester:** 8th
Examination: End Semester Examination
Examination year: May - 2023

Course Code: CE-422 **Course Name:** Ground Improvement and Geosynthetics
Date: 17/05/2023
Time: 10:00 am to 12:00 pm

Total Marks: 40
Total Pages: 02

Instructions:

- Write each answer on a new page.
- Use of a calculator is permitted
- Draw figures wherever applicable.
- Copies of FHWA-NHI-00-043 (2001) Mechanically Stabilized Earth Walls And Reinforced Soil Slopes Design & Construction Guidelines are allowed for design examples of retaining walls.

Q. No.	Details	Marks	CO	BTL
Q.1	<p>Short Questions (Any 10)</p> <ol style="list-style-type: none"> 1. Counterforts are provided in retaining wall to reduce shear force & bending moment in the vertical stem & the base slab. (True/False) 2. Cohesionless soils are preferred as back fill material in the construction of MSEW walls. (True/False). 3. _____type of rollers can achieve a higher rate of compaction at greater depths. (a) Pneumatic rollers; (b) Impact rollers; (c) Sheep foot rollers 4. Sand drains (PVD) provide the shortest path for the water to flow through to get away from the soil. (True/ False) 5. An International airport is to be developed near Dholera in Gujarat. The city lies in the seismic zone 3. The soil investigation reports reveal that the soil has the following grain size distribution: Gravel = 20%, Sand =20%; Silt = 0% and clay = 60%. Comment with reason in one line, whether the soil strata has potential to liquefy or not. 6. _____type of geosynthetics can be used as filter in retaining walls. (a) Geomembrane; (b) Geocell; (c) Geotextile 7. Soil possessing different thermal conductivity possess different rates of ground freezing. (True/ False) 8. Non -woven geotextile has higher permeability as compared Woven geotextile. (True/ False) 9. If geogrid is to be used as reinforcement then tensile strength from _____type of tensile test should be used. 	10	1,2,3,4	1,2,3

	<p>(a) Narrow width tensile test; (b) Wide width tensile test; (c) Trapezoidal tensile test</p> <p>10. Embedment depth of foundation for retaining wall should be atleast _____.</p> <p>(a) 0.2m (b) 0.45 m ; (c) 2m; (d) 1.5 m</p> <p>11. In-plane permeability of geosynthetic material is called Transmissivity. (True/ False)</p>			
Q.2	<p>Explain the compaction grouting technique for cohesionless soils in detail.</p> <p style="text-align: center;">OR</p> <p>State types of vertical drains and explain prefabricated vertical drains in detail</p>	5	1,2	1,2,3
Q.2		5		
Q.3	<p>Explain wide width tensile strength test in detail.</p> <p style="text-align: center;">OR</p>	5	3	1,2,3
Q.3	<p>Explain the direct shear test for pullout capacity of Geosynthetics in detail.</p>	5		
Q.4	<p>Explain the various durability properties of Geosynthetics in detail.</p>	5		
Q.5	<p>Determine the sliding and over turning stability of the cantilever retaining wall shown in figure below. Use Rankine's theory. Take unit weight of concrete as 24kN/m^3.</p>	7	4	3,4,6
Q.6	<p>Determine the vertical spacing and total length of reinforcement for a modular block facing reinforced retaining wall. Height of wall is 8.0m and geogrid is to be used as reinforcing element. Other details of the wall are as follows: (8 marks)</p> <p>Properties of backfill soil:</p> <ul style="list-style-type: none"> ▪ $\phi_b = 30^\circ$ ▪ $\gamma_b = 18 \text{ kN/m}^3$ ▪ $\delta_b = 22.7^\circ$ <p>Properties of reinforced soil:</p> <ul style="list-style-type: none"> ▪ $\phi_r = 36^\circ$ ▪ $\gamma_r = 22 \text{ kN/m}^3$ 	8	4	3,4,6

Foundation soil properties:

- $\phi_f = 33^\circ$
- $\delta_f = 18.8^\circ$
- $c_f = 27 \text{ kPa}$
- $\gamma_f = 22 \text{ kN/m}^3$

- Coverage ratio (C_r) = 0.8
- Surcharge load (q) = 18 kN/m^2
- Allowable tensile strength of geogrid (T_a) = 100 kN/m
- Interaction coefficient (C_i) = 0.75
- $\text{FOS}_{(\text{Pullout})} = 1.5$

OR

Q.6

Check the external stability (Sliding, Overturning and Bearing) of a 8 m high geogrid reinforced soil retaining wall with corresponding details: -

8

4

Height of wall (H) = 8m

Maximum Length of reinforcement (L) = 8.0 m

Vertical spacing of reinforcements (S_v) = 0.8 m.

Allowable tensile strength of geogrid (T_a) = 100 kN/m

Take reinforcement coverage ratio (C_r) as 0.8.

Surcharge load = 21 kPa

$C_i = 0.8$

Reinforced and Backfill soil properties:

- $\phi = 34^\circ$
- $\gamma = 21 \text{ kN/m}^3$
- $\delta = 30^\circ$

Foundation soil properties:

- $\phi_f = 30^\circ$
- $\delta_f = 24^\circ$

- $c_f = 35 \text{ kPa}$
- $c_{af} = 26.5 \text{ kPa}$
- $\gamma_f = 20 \text{ kPa}$
- Allowable Bearing capacity = 1000 kPa

*****End of Question Paper*****