Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL (A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH (CIVIL ENGINEERING) END SEMESTER EXAMINATIONS NOVEMBER/DECEMBER 2018

SUBJECT: SOIL REINFORCEMENT AND GEOSYNTHETICS [CIE 4012]

Date of Exam:

Time of Exam:

Max. Marks: 50

Instructions to Candidates:

✤ Answer ALL the questions & missing data may be suitably assumed

1A.	Discuss how, the form and dimension of reinforcement affect the behavior and performance of reinforced soil.	(03)	CO1
1B.	State and explain how to determine the physical properties of geotextile.	(05)	CO2
1C.	Compute the pullout capacity of a)A steel strip of width 80mm and thickness 12mm. b) Geotextile sheet thickness 15mm, buried in horizontal position at a depth of 8m and having length 3.8m in sand with properties γ =18kN/m ³ , ϕ = 31°, c =0. For soil-metal take adhesion factor 0.76 and soil-geotextile take adhesion factor as 0.89.	(02)	CO3
2A.	It is required to design the reinforcement for a steep embankment resting on a competent soil. The driving moment is 2600kN-m and resisting moment is 1950 kN-m. If geotextile of allowable tensile force 25kN/m is proposed to be used to reconstruct the slope with FOS 1.5, determine the number of layers of reinforcement to be provided. The average centroid of reinforcement is 6m away (vertically) from the center of rotation.	(02)	CO3
2B.	An 8 m high wall supports soil with horizontal surface. The properties of the backfill soil are c=0, ϕ =35° and γ =20 kN/m ³ . The initial length of the reinforced soil block (c=0, ϕ =36° and γ =19.5 kN/m ³) was assumed as 6 m. The surcharge is 25 kPa. The foundation soil has properties of c=25 kPa and ϕ =40°, γ =20 kN/m ³ and safe bearing pressure of 280 kN/m ² . Check for external stability. Also Determine the thickness of the strip to be provided at depth 6m such that it will not rupture, given that yield stress in steel is 250000 kN/m ² . Assume horizontal and vertical spacing of strips as 1m, factor of safety against rupture = 1.5, and width of strip as 0.1m.	(04)	CO3
2C.	It is required to construct a steep slope of 70° of height 7m using granular soil having properties of c=0, ϕ =35° and γ =20 kN/m ³ . Uniform surcharge pressure is 25 kPa. Estimate the total tensile capacity of reinforcement using planar wedge method to achieve a factor of safety of 1.50. If the long term allowable design strength of reinforcement is 29 kN/m, find the number of reinforcement layers and the permissible and safe vertical spacing for depths 1m,2m,3m,4m,5m, 6m and 7m.	(04)	CO3
3A.	A strip footing is to be designed to carry a load of 1500kN/m. The foundation soil properties are c=0, ϕ =32° and γ =19 kN/m ³ . Reinforcement parameters are yield strength = 2.5 x 10 ⁵ kN/m ² , interface friction angle δ =28°, factor of safety against rupture = 3 and factor of safety against pullout = 1.7. The safe bearing capacity of unreinforced soil is 338 kPa. Width of the ties = 75mm, LDR = 70%, depth of foundation = 1m, width of foundation = 1m, design life = 100yrs and rate of corrosion is 0.025mm/year. Three reinforcements are provided at a vertical spacing of 300mm and first layer is provided at a depth of 300mm below the footing. Design the reinforced foundation soil. Refer figure 3A and 3B.	(04)	CO3

3B.	Compare the soil nailed walls with reinforced soil wall. Also state the advantages of soil nail wall.	(03)	CO4
3C.	Explain any three application of geosynthetics in paved roads with neat sketches.	(03)	CO4
4A.	Explain with neat sketch the modes of crack propagation in pavements and the remedial measures using geosynthetics.	(05)	CO4
4B.	Discuss the filter requirements of a geotextile.	(05)	CO5
5A.	Estimate the quantity of flow behind a retaining wall of 8m height having a geosynthetic drainage medium. The backfill soil has coefficient of permeability of 1.5×10^{-5} m/s. From the flow net it is found that the number of flow paths and equipotential drops are 8 and 9 respectively. Head causing flow is equal to height of wall. Also determine factor of safety for a non-woven geotextile with allowable transmissivity of 6 x 10^{-5} m ² /s.	(03)	CO5
5B.	What is a GCL? Explain their use in landfills.	(02)	CO5
5C	Sketch the cross-section of a typical landfill to store hazardous waste and show the different components in a landfill. Clearly explain where each type of geosynthetic (geogrid, geotextile etc.) can be used in a landfill.	(05)	CO5



Fig 3A. Variation of $A_1, A_2, \text{and } A_3$ with z/B (after Binquet and Lee, 1975b)

z/B Fig 3B. Variation of *Lo/B* and Xo/B with *z/B* (after Binquet and Lee, 1975b)

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