Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH (CIVIL) END SEMESTER EXAMINATIONS DECEMBER 2020

SUBJECT: SOIL REINFROCEMENT AND GEOSYNTHETICS [CIE 4012]

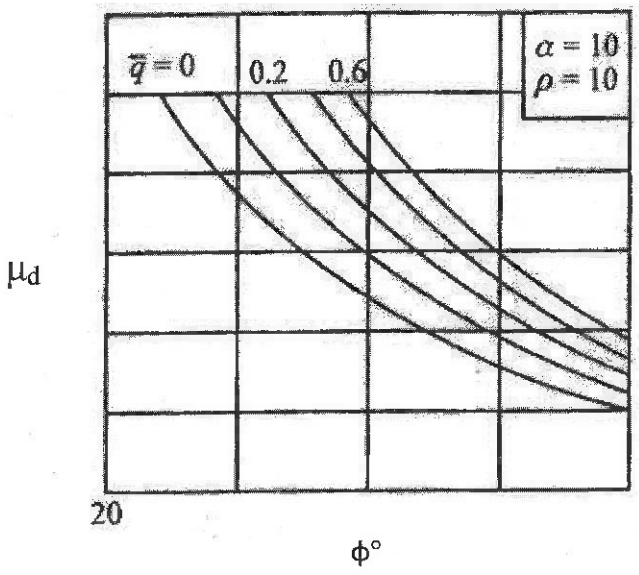
Date of Exam: **/12/2020** Time of Exam: Max. Marks: **50**

Instructions to Candidates:

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

1A.	Differentiate with respect to manufacturing process and application between i) Geogrid and geotextile ii) Geonet and geomembrane	**4**
1B.	State the differences between the permittivity and transmittivity. What is the significance of gradient ratio?	**3**
1C.	A 7 m high wall supports soil with horizontal surface. The properties of the backfill soil are c=0, ϕ=34° and γ=18.5 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 on the soil is 14kPa respectively. The foundation soil has properties of c=20 kPa and ϕ=37°, γ=20 kN/m^3 and safe bearing pressure of 240 kN/m^2. Check for external stability.	**3**
2A.	A retaining wall of 7m height with geotextile reinforcement and granular soil having γ=18 kN/m^3 and φ =36° is to be constructed. The backfill is a granular soil having γ=18.5 kN/m^3 and φ =33°. A woven slit film geotextile with warp or machine direction ultimate wide width strength of 60 kN/M and having δ=24° is used in construction. Orientation of geotextile is perpendicular to wall face. FOS of 1.5 is used. Find a) Vertical spacing of individual layers of geotextile (maximum 1m and first layer at 0.75m). b) Length of geotextile layers. c) Check for sliding and overturning failure. The backfill surface carries a uniform surcharge load of 6 kN/m. Take RF_{ID} =1.2,RF_{CR}=2.5, RF_{CD} = 1.15, RF_{BD}=1.1	**6**
2B.	Design a reinforced steep slope at 70° angle and height of 5m. The slope is constructed using granular soil having c= 0, φ = 31° and γ = 19kN/m^3. The design strength of reinforcement is 20 kN/m. Uniform surcharge pressure is 24 kN/m^2. Find the number of reinforcement layers required and permissible vertical spacing at an interval of 1m from the surface. Required factor of safety is 1.5. Use planar wedge analysis.	**4**
3A.	Consider a 10m high, near vertical slope in an urban area in a sandy soil. The ground water is very deep and beyond the bottom of excavation. The following data is given: unit weight of soil = 18.6 kN/m^3, surcharge pressure = 20kN/m^2 and friction angle is 36.26°. It is proposed to use 20mm diameter steel bars of 6m length for soil nailing. The site requirements are that the line through which nails end needs to be 10° with vertical and vertical spacing be 1m. The wall has an inclination of 10°.	**4**

3B.	A strip footing of width 1m is founded at a depth of 1.5m from ground level. The foundation soil properties are γ = 18 kN/m^3, φ = 32° and c=0. The first reinforcing layer is placed at a depth of 0.5m below the footing. There are four layers of reinforcement provided at a vertical spacing of 0.5m. The tie forces in the 1st, 2nd, 3rd and 4th layers of reinforcement are 54.7 kN/m, 60.2kN/m, 63.8kN/m and 66.5kN/m respectively. It is found that length of reinforcement in 2nd, 3rd and 4th layer is very high. The safe bond stress ratio is 1.7 and length of 1st reinforcement layer is 3.0m. Design such that curtailed length of reinforcement in 2nd, 3rd and 4th layer is restricted to 3.0m using anchor plates of width 100mm. Assume factor of safety against pull-out is 2.0.	**3**
3C.	Differentiate between i) Grouted nail and driven nail ii) Reinforced retaining wall and reinforced soil slopes	**3**
4A.	Discuss the application of geosynthetics in paved roads.	**3**
4B.	Non-woven geotextiles are provided in dam to act as a filter at the downstream side. The geotextile is a 20 mm thick, 2800 g/m^2 geosynthetic with an allowable permittivity of 0.08 /s and O_{95} of 0.06mm. The soil in the dam is clayey silt with D_{85} of 0.04mm and k = 6.3 x 10^{-8} m/s. The seepage estimated using flow nets is 15.2 x 10^{-7} m^2/s-m. Comment on suitability of geosynthetic to be used as filter.	**3**
4C.	Discuss the application of geotextile as drainage material with examples.	**4**
5A.	What is Reflection cracking? How to prevent occurrence of reflection cracking using geosynthetics?	**2**
5B.	Explain the liner systems used for municipal solid waste and hazardous waste landfill.	**4**
5C.	Illustrate the functions of geosynthetics in landfills.	**4**



Design charts for nailed walls and slopes with L/H = 0.6 by Gassler, 1996