

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- Dec. 2017

M.Tech. III Semester

COURSE CODE: 15M3WCE311

MAX. MARKS: 35

COURSE NAME: Environmental Geotechnics

COURSE CREDITS: 3

MAX. TIME: 2 Hours

---

*Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means. Assume data, if necessary.*

---

[1] A branch gas collection line carries  $40 \text{ m}^3/\text{min}$  of landfill gas over a distance of 135 m where condensate will drain and be collected. Average initial temperature of the gas at the beginning of the line is  $62^\circ\text{C}$ . Temperature at the drop out point is  $25^\circ\text{C}$ . The header is at 762 mm Water Column (W.C.) vacuum (average). What is the quantity of landfill gas condensate that would be condensed out in the header pipe? Take

At  $20^\circ\text{C}$ : vapor pressure of water = 0.023 bar

At  $50^\circ\text{C}$ : vapor pressure of water = 0.123 bar

25.4 mm W.C. = 0.00249 bar [6]

[2] Describe with the help of a neat and labeled diagram, the laboratory method for determination of longitudinal dispersivity ( $\alpha_L$ ) and transverse dispersivity ( $\alpha_T$ ). [6]

[3] Determine the expression for effective permeability of the soil – Bentonite mix and Bentonite slurry system of the soil – Bentonite trench wall. For the soil – Bentonite backfill, permeability is  $k_s$  and its thickness is  $t_s$ . The Bentonite film formed on the sides of the trench has permeability  $k_b$  and thickness  $t_b$ . [6]

[4] In a MSW landfill, there are 7 essential components that have to be provided for it to function satisfactorily. State the problem that will arise in each of the following cases if 6 essential components are provided but the following one component is eliminated:

(a) Cover system

(d) Leachate collection system

(b) Environmental monitoring system

(e) Gas collection system

(c) Surface water drainage system

(f) Post closure plan [6]

[5] A 200 mm diameter HDPE pipe with SDR = 11 is perforated with 6 mm holes per foot (i.e. 4 holes per side per foot) is selected as a primary leachate collection pipe. The maximum load acting on the pipe is 72 kN/m by a fill of height 50 m. Assume bedding angle  $\theta = 0^\circ$  with  $K = 0.11$ , deflection lag factor  $D_L = 1.0$ , elastic modulus of pipe material as  $E = 194000 \text{ kN/m}^2$ , Poisson's ratio of pipe material = 0.3. The bedding material of the pipe is poorly graded gravel (GP) with 85% standard density as given in Table 1. The allowable deflection ratio of SDR11 HDPE pipe is 2.7%. Determine:

- a) Deflection ratio (%)
- b) Check for critical buckling pressure of the pipe. [4+4 = 8]

Table 1. Properties of bedding material of pipe

Soil Type	Stress level $P_p$ (kN/m <sup>2</sup> )	85% Standard Density
		$E_s$ (kN/m <sup>2</sup> )
SW, SP, GW, GP	138	22754
	276	28270
	414	32407

[6] Describe the principle of flow in unsaturated soils and the moisture characteristic curves.

[3]