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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2013/2014**

COURSE NAME : GEOENVIRONMENT
COURSE CODE : BFG 40303
PROGRAMME : 4 BFF
EXAMINATION DATE : DECEMBER 2013 / JANUARY 2014
DURATION : 3 HOURS
INSTRUCTION : ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

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- Q1**
- (a) Define the following:
- i) Hazardous waste
 - ii) Contaminant
 - iii) Contaminated land
 - iv) Brownfield
- (8 marks)
- (b) Discuss reasons why (or why not) each of the following might be considered hazardous waste under Environmental Protection Agency (EPA) regulations:
- i) a railroad tank car of fuming sulfuric acid
 - ii) solvents, after use as cleaning agents
 - iii) radioactive tracers after use in a university lab
- (9 marks)
- (c) In Malaysia, before EQA 1974, (or US, before 1970s,) it was not illegal to dispose of hazardous chemicals in unlined pits, and many companies did so. Should they be held responsible today for the contamination those wastes are causing, or should the government (taxpayers) pay for the cleanup? Give a rationale for your answer.
- (8 marks)
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- Q2**
- (a) List **FIVE (5)** mitigation techniques that are used for soil and groundwater contamination.
- (5 marks)
- (b) Explain details of two mitigation techniques as listed in answer **Q2 (a)**.
- (8 marks)
- (c) Discuss details how accidental release of hazardous chemicals into the subsurface would affect the environment. How may an engineer prevent releases by containment facilities?
- (12 marks)

- Q3**
- (a) Label each of the components in Figure Q3. Describe the function of each component. (10 marks)
- (b) Explain why the methods listed below are more suitable for the monitoring of groundwater quality. (6 marks)
- i) Construction of monitoring well using percussion method rather than drilling method
 - ii) Installation High Density Polyethylene (HDPE) pipe rather than Polyvinyl Chloride (PVC) pipe
 - iii) Sampling of groundwater sample using purge pump rather than submersible pump
- (c) Based on literature review a number of researchers made a statement that the main polluting substances of geoenvironment are oil products. Discuss the effects of this contaminants on the engineering properties of soils particularly the unconfined compression strength, compressibility and hydraulic conductivity. (9 marks)
- Q4**
- (a) Explain the difficult aspect of in-situ electrokinetic method and phyto remediation technique in the remedial of soil contamination problem. (8 marks)
- (b) An underground storage tank removal project resulted in a 280 m³ of gasoline contaminated soil pile that has to be treated before disposal. Bioremediation has been selected as the treatment method. The porosity of soil is 34% and initial degree of saturation is 20%. Determine the amount of water needed for the first spray. (7 marks)
- (c) Discuss the advantages and disadvantages of soil vapor extraction and soil washing approaches in soil remediation. (10 marks)

- Q5** (a) Explain with examples the potential sources of soil and groundwater contamination. (8 marks)
- (b) Discuss **FOUR (4)** methods commonly used for domestic waste disposal. (8 marks)
- (c) Describe the monitoring programme for the operation of a landfill to meet the required Department of Environmental (DOE) regulations. (9 marks)
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- Q6** (a) Define the advection, diffusion and dispersion process in the transportation of contaminants. (6 marks)
- (b) Explain the advection, diffusion and dispersion processes of the transportation of contaminants in marine clay and sandy aquifer material. (4 marks)
- (c) A site investigation study has revealed that the site contains mixed chemical buried beneath the ground surface and extending to a depth of 1m, as shown in Figure **Q6**. A thick layer of clay measuring 3m in depth was found under the buried waste. The groundwater table was found at a depth of 0.5m from the ground surface. Groundwater chemical analysis has shown that one of dominant pollutants has a concentration, c_e , of one half of initial concentration, c_0 , at a depth of 1m from the ground surface. The clay soil has a porosity of 0.45 and hydraulic conductivity of 5.2×10^{-9} m/sec. Dispersion coefficient, α , is 1m. Calculate the transient time by considering:
- i) advection
ii) diffusion (15 marks)

-END OF QUESTION-

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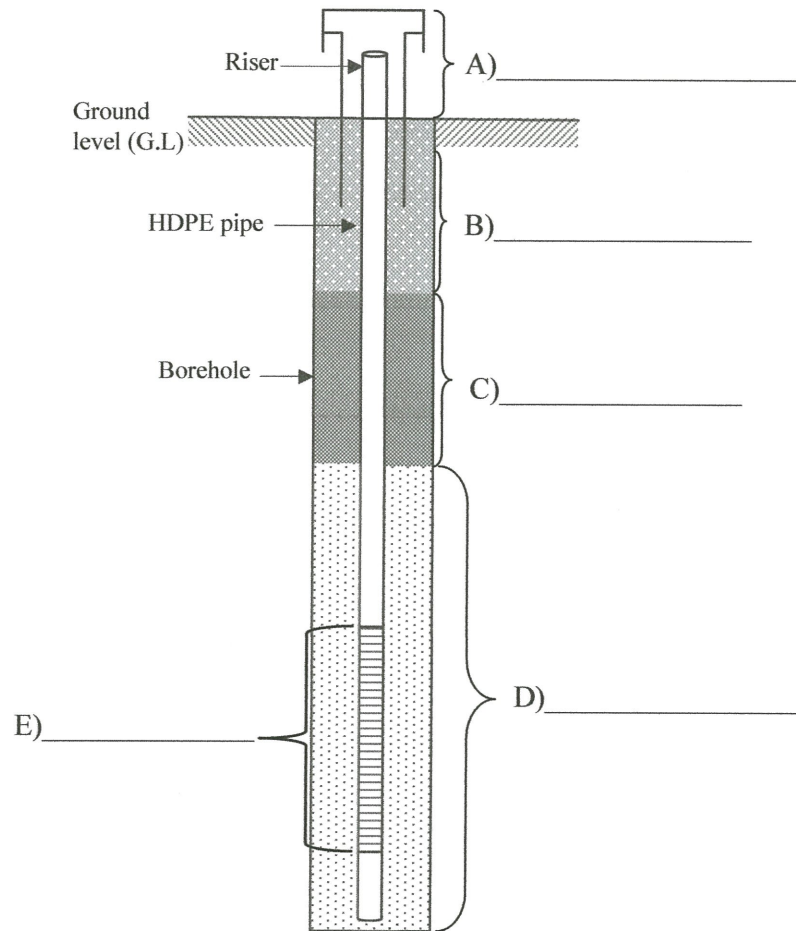


FIGURE Q3

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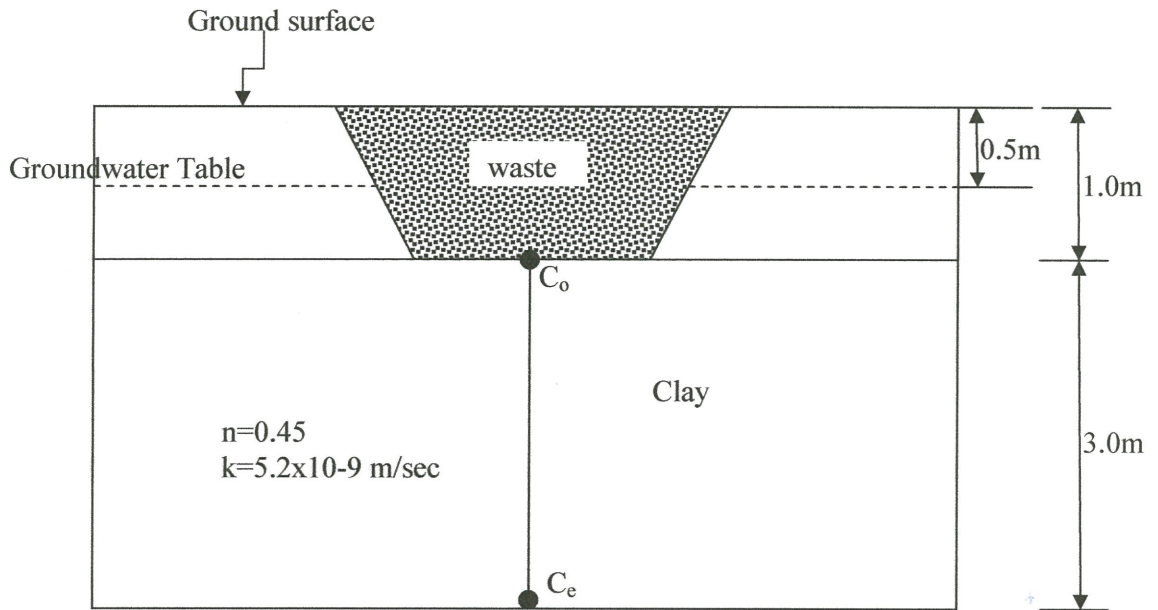


FIGURE Q6

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FORMULA Q6

$$\frac{c(x, t)}{c_o} = \operatorname{erfc}\left(\frac{x}{2\sqrt{D_s t}}\right)$$

TABLE Q6

t (years)	ξ	$\operatorname{erfc}(\xi)$	C_e/C_o
5		0.1460	
10		0.3040	
20		0.4672	
25		0.5155	
30		0.5528	