Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018

COURSE NAME	:	GEOENVIRONMENT
COURSE CODE	:	BFG40303
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JUNE/JULY 2018
DURATION	:	3 HOURS
INSTRUCTIONS	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) Geoenvironmental engineering has evolved from a specialization within geotechnical engineering to a broad, multi-disciplinary engineering field. Summarize any **THREE (3)** factors that encouraged this evolution.

(9 marks)

(b) Malaysia is a country rich in water resources as it receives a high rainfall. In 2016, Kuching station recorded the highest annual rainfall of 5,423.0 mm with an increase of 877.5 mm as compared to 2015 (4,545.5 mm). Briefly synthesize the potential impact of this phenomenon on the waste containment facilities to be built in that area from the aspect of its location chosen, performance and remediation of contaminated sites.

(9 marks)

(c) Soil additives are identified as one of the sources of soil contamination. Analyse how the contamination occurs from the aspect of soil chemistry.

(7 marks)

Q2 (a) Mobile colloids in the subsurface environment may alter the transport of contaminants.

(i) Briefly explain how it may happen.

(4 marks)

(ii) Analyze the potential problem if role of colloids in facilitating contaminant transport is not taken into consideration.

(6 marks)

(b) Most contaminants are introduced to the subsurface by percolation through soils. Summarize the process involved for contaminants that are highly soluble and contaminants that are not highly soluble to be migrated to groundwater.

(8 marks)

(c) (i) Define what is referred as chemical retardation.

(2 marks)

(ii) Briefly describe with any example the application of chemical retardation in managing contaminant transport.

(5 marks)

Q3 (a) As a geoenvironmental engineer, you are required to characterize a potentially contaminated site. Briefly explain any **THREE (3)** main aspects should be covered by the site characterization program that to be planned.

(6 marks)

(b) All sampling works should be conducted in a manner that maintains sample integrity and encompasses adequate quality assurance and control. Summarize any **FOUR (4)** main aspects that should be considered to ensure high sampling efforts.

(10 marks)

(c) Design and propose a series of site monitoring program for a site that contaminated by effluents from textile industry.

(9 marks)

Q4 (a) Contaminated site remediation techniques can be broadly divided into **FIVE (5)** different approaches. Name any **THREE (3)** of the approaches and briefly describe the mechanisms involved for each approaches.

(9 marks)

(b) One of the challenges of using geomembrane as waste containment layer is its puncture protection. It is given that coarse grained gravel which is subrounded with $d_{50} = 38$ mm will proposed as leachate (harsh leachate) collection layer to be placed on a 1.5 mm thick HDPE geomembrane under a 45 m high landfill. Assume that the solid waste unit weights is 12 kN/m^3.

Determine the geotextile mass per unit area for a FS value of 3.0 with protrusion height of

(i) 25 mm

(ii) 12 mm

(8 marks)

(c) Plants such as *Thlaspi, Urtica, Chenopodium, Polygonum sachalase* and *Alyssim* have the capability to accumulate cadmium, copper, lead, nickel and zinc. Discuss the efficiency of Phytoremediation technique in remediation of soil contaminated by heavy metals.

(8 marks)

–END OF QUESTIONS–

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TABLE Q4: Modification factors and reduction factors for geomembrane protection design using nonwoven needle-punched geotextiles

Modification Factors (all ≤ 1.0)

MF_s		MF_{PD}		MF_A	
Angular	1.0	Isolated	1.0	Hydrostatic	1.0
Subrounded	0.5	Dense, 38 mm	0.83	Geostatic, shallow	0.75
Rounded	0.25	Dense, 25 mm	0.67	Geostatic, mod.	0.50
		Dense, 12 mm	0.50	Geostatic, deep	0.25

Reduction Factors (all ≥ 1.0)

RF_{CBD}		RF_{CR}			
		Mass per Unit Area (gm/m^2)	Protrusion Height (mm)		
			38	25	12
Mild leachate	1.1	Geomembrane alone	N/R	N/R	N/R
Moderate leachate	1.3	270	N/R	N/R	>1.5
Harsh leachate	1.5	550	N/R	1.5	1.3
		1100	1.3	1.2	1.1
		>1100	≅1.2	≅1.1	≅1.0

Abbreviations: N/R = not recommended

$$p_{allow} = \left(50 + 0.00045\frac{M}{H^2}\right)\left[\frac{1}{MF_S \times MF_{PD} \times MF_A}\right]\left[\frac{1}{RF_{CR} \times RF_{CBD}}\right]$$