Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2020/2021

COURSE NAME	:	SEDIMENT TRANSPORT
COURSE CODE	:	BFW 40603
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) Examination of a large number of samples in this way indicates that the size-frequency distribution curve approximates a normal probability curve. However, in some cases the distribution is skewed.

(i) By the aid of diagram, compare the different between normal and skewed distribution.

(5 marks)

(ii) A sieve analysis of sediment particles gives the distribution as shown in **TABLE Q1(a)(ii)**. Determine the mean, variance and standard deviation.

(5 marks)

(b) Based on the data in **TABLE Q1(b)**, determine the equilibrium slope by the three-slope method using the criteria proposed by Shields. Preliminary studies show that 2.5×10^6 m^3 of sand would deposit behind a diversion dam during the 100-year economic life of the structure. Assume that an equal volume of sand could be eroded from the downstream channel.

(15 marks)

Q2 (a) A wide stream has a depth of 0.6 m and the bed slope is 0.0008. The bed consists of a mixture of heavy particles (ρ_s = 2980 kg/m^3) with a median particle size (d_{50} = 950 mm). Compute the bed-load transport rate using the formulae of Meyer-Peter and Van Rijn for uniform equilibrium flow conditions.

(9 marks)

(b) By using the data tabulated in **TABLE Q2(b)**, determine the following conditions:

(i) The flow depth, D for the channel shown in **FIGURE Q2(b)(i)** using Einstein procedures.

(12 marks)

(ii) The water discharge using the value calculated in (i).

(4 marks)

Q3 (a) Explain in detail the diffusion and dispersion of suspended sediment particles that will not eventually deposited at the river bed for turbulent flow.

(3 marks)

(b) Determine the suspended load using Brooks' method if q = 5(m^3/s)/m; R = R' = D = 5m; Ca = 0.0001 by dry weight; g = 9.81m/s^2; d_{65} = 0.0006m; a = 0.25m; n = 0.02; ν = 0.000001m^2/s; ω = 0.07m/s; S = 0.0001; γ = 1000kg/m^3.

(12 marks)

(c) Determine the discrepancy ratio of the channel using Ackers White equation and discuss the suitibility of this equation to the flow characteristics.
Apply the data given as stated below.

Flow discharge, Q	0.6 (m^3/s)
Average velocity, V	0.42 (m/s)
Flow area, A	1.43 (m^2)
Hydraulic radius, R	0.24 (m)
Flow width, B	5.70 (m)
Slope, S	0.0010
Water temperature,	25 (°C)
Bed load, Q_b	9.48 x 10^{-6} (m^3/s)
Suspended load, Q_s	9.60 x 10^{-6} (m^3/s)
Mean diameter, d_{50}	1.1 (mm)
Sediment density, ρ_s	2650 (kg/m^3)
Sediment specific gravity, γ_s	2.650
$[(\gamma_s/\gamma) - 1]$	1.650
Gravity acceleration, g	9.81 (m/s^2)
Kinematic viscosity, v	1.0 x 10-6 (m^2/s)
Shape factor, SF	0.7

(10 marks)

Q4 (a) Explain in your own words the mechanism of scour and one of the best way for scouring protection.

(6 marks)

(b) Determine the rate of surface erosion based on the unit stream power theory that log $C_t = I + J \log (VS/\omega - V_{cr}S/\omega)$ *($I = 5.0105 \pm 0.0443$; $J = 1.363 \pm 0.030$; $V_{cr}S = 0.002m/s$)* and the following experimental results:

Mean sediment diameter, d_{50}	0.2 (mm)
Sediment fall velocity, ω	0.024 (m/s)
Slope, S	0.040
Water discharge per unit width, Q/B	0.0003 ($m^3/s/m$)
Manning roughness coefficient, n	0.030

(10 marks)

(c) The lost storage capacity of a reservoir can be recovered by flushing, dredging, or siphoning. Explain in detail the advantages and disadvantages of each and every method mention.

(9 marks)

– END OF QUESTIONS –

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TABLE Q1(a)(ii): Sieve analysis of Sediment Particles

Sieve Size (mm)	% Passing
0.08	5
0.12	8
0.16	17
0.20	20
0.24	15
0.28	10
0.32	10
0.38	8
0.40	7

TABLE Q1(b): Characteristic of Degraded Channel Profile

Dominant Discharge, Q (m^3/s)		250
Channel Width, B (m)		120
Mean Channel Depth, D (m)		0.4
Existing Stream Gradient, S_O		0.0015
Bed Material, mm	$D_m = D_{50}$	0.3
	D_{90}	0.96
Manning's Roughness Coefficient, n		0.03
Original Bed Elevation, m		30.5

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TABLE Q2(b): Channel Characteristic

S.G Sand	Q (m^3/s)	B (m)	ν (m^2/s)	S	D_{35} (mm)	D_{65} (mm)
2.65	40	5.0	10^{-6}	0.0008	0.3	0.9

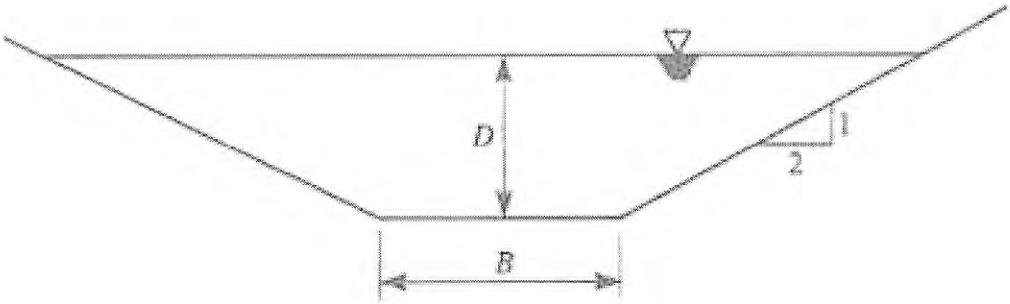

FIGURE Q2(b)(i): The Channel Measurement