NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF INDUSTRIAL TECHNOLOGY
BACHELOR OF ENGINEERING (HONS) DEGREE
DEPARTMENT OF CIVIL AND WATER ENGINEERING
PART V SUPPLEMENTARY EXAMINATIONS- AUGUST 2014

HYDRAULIC DESIGN II – TCW5201

Instructions:
Answer <u>ALL</u> questions   Total marks: 100

All questions carry equal marks   Time: 3 hours

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QUESTION 1

    a. With aid of neatly labeled sketches describe how the venturi flume is used to measure flow in an open channel.   (10 marks)

    b. With aid of neatly labeled sketches describe the various types of earth dams. (10 marks)

    c. Describe the effects of sedimentation in reservoirs and suggest ways to counter these. (5marks)

[25 marks]

QUESTION 2

    a. If a broad crested weir has a coefficient of discharge C_d= 1.65 and it completely spans a 17.4m wide rectangular channel, what would be the head over the weir when the discharge is $6.8m^3/s$?   (15 marks)

    b. Estimate the discharge for a venturi flume with a level invert, having a throat width of 1m installed at one point of a rectangular open channel 2m wide if:

        i.   The upstream depth is 1.2m and the critical flow occurs in the flume

        ii.   If the upstream depth is 1.2m and the depth in the throat is 1.05m. Assume C_v =1 and C_d= 0.95   (10marks)

[25 marks]

QUESTION 3

    An overflow spillway 80m wide carries a maximum discharge of $400m^3/sec$. Define the crest profile for the spillway, assuming a 3:1 upstream slope and a 2:1 downstream slope and that C=2.2.   [**25 marks**]

QUESTION 4

a. Discuss the factors to consider when siting a dam. (5 marks)

b. A concrete gravity dam has an overall height of 30m, with a freeboard of 3m and a crest width of 4m. The dam has a 1:4 upstream face slope and a 1:2 downstream face slope. Assume that the uplift force takes a triangular distribution with maximum magnitude one third that of the hydrostatic pressure at the heel and at the toe. The specific gravity of the concrete is 2.65 and the coefficient of friction (μ) between the dam base and the foundation is 0.65. Check the dam for stability against overturning and sliding. State any assumptions made clearly.

(20 marks)

[25 marks]

Useful information
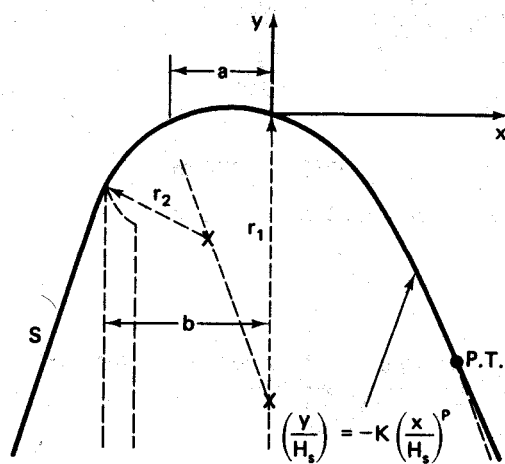
Upstream slope (vert/hor.)

	3/0	3/1	3/2	3/3
a/H_s	0.175	0.139	0.115	0
b/H_s	0.282	0.237	0.214	0.199
r_1/H_s	0.50	0.68	0.48	0.45
r_2/H_s	0.20	0.21	0.22	—
K	0.500	0.516	0.515	0.534
P	1.850	1.836	1.810	1.776

$$\left(\frac{y}{H_s}\right) = -K\left(\frac{x}{H_s}\right)^P$$

Figure 8.12 Overflow spillway profile.