NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF INDUSTRIAL TECHNOLOGY
DEPARTMENT OF CIVIL ANDWATER ENGINEERING
BACHELOR OF ENGINEERING (HONOURS) DEGREE
PART V SECOND SEMESTER EXAMINATIONS MAY 2006
HYDRAULICS DESIGN II—TCW 5201

INSTRUCTIONS

*Answer **ALL** questions. Illustrate your answers, where appropriate with clearly labeled sketches. Each question carries 25 marks.*

Total marks: 100 *Time: 3 hours*

QUESTION 1

a). Briefly explain the functions of filters and their designing criteria in embankment dams. [10 marks]

b). Seepage control in embankment engineering is a great challenge to engineers. Discuss ways or methods in which you would control seepage. In your answer you must reveal the distinction between seepage through the dam mass and that through the foundation. [15 marks]

QUESTION 2

A design-construct firm has proposed a concrete gravity dam shown below, Fig.Q2. All dimensions are in metres. Given that soil cohesion coefficient $c = 1000kN/m^2$, unit weight of concrete and water respectively $\gamma_C = 24kN/m^3$, $\gamma_w = 9.81kN/m^3$ and The coefficient of internal friction, $\tan \varphi = 0.75$.

a). On a separate answer sheet show the pressure diagram showing all the forces affecting the stability of the dam. [8 marks]

b). Show whether the structure satisfies competence criteria with respect to
i) overturning [5 marks]
ii) sliding stability (factor) [5 marks]

c). In case of a small value of overturning factor how would you increase it without

changing the structural dimensions of the given profile? In the given profile, by what percentage would the overturning factor change? [7 marks]

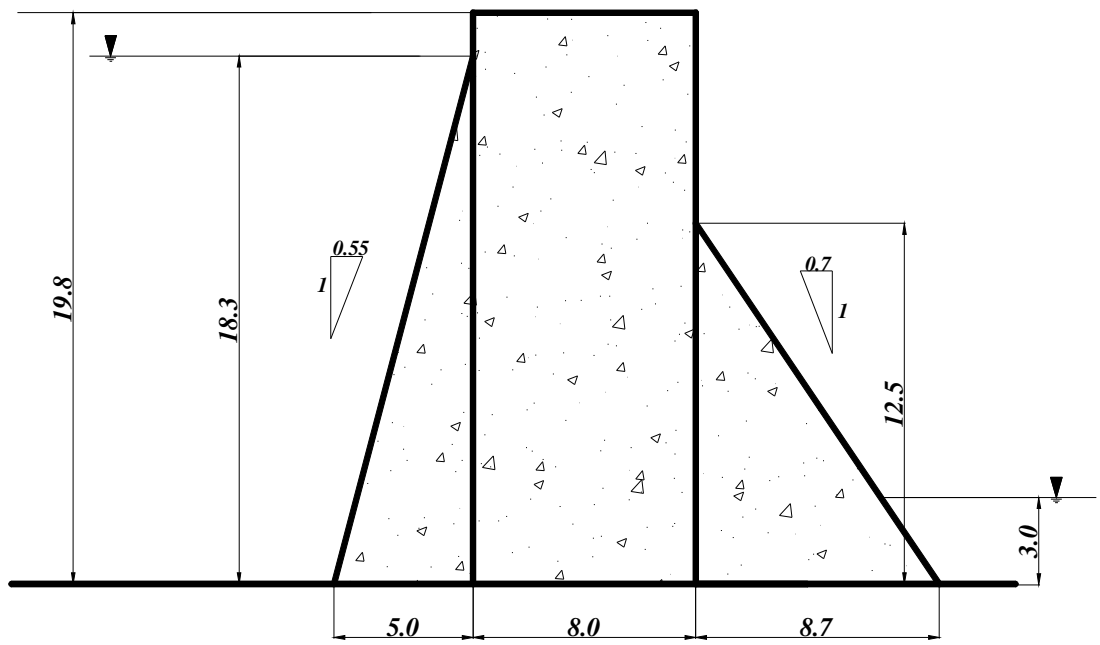

Fig.Q.2

QUESTION 3

a). After a tectonic landslide, rock masses barricaded a mountain stream on a steep sloped gorge to form a dead end dam wall. With time the accumulation of water behind the dam wall posed a danger to the settlement downstream. How would you as an engineer propose to solve the problem? [5 marks]

b). Out line the principles and procedures of designing a siphon spillway for a given discharge Q. [12 marks]

c). i). Why is it necessary to provide energy dissipation on the tail water side of a spillway dam? *(Illustrate your answer schematically where necessary)* [4 marks]

ii). Give two methods of energy dissipation on the tail water side of a spillway dam. [4 marks]

QUESTION 4

a). Describe measures taken to minimize sediment input to a reservoir. [7 marks]

b). The inflow to reservoir has an average sediment concentration of 800ppm. If the volume of the reservoir is 100 x 10^6 m^3 and the annual flow of the river is 900 x10^6 m^3, determine the approximate 'half-life' of the reservoir. Assume that average porosity of the settled sediment over this period is 0.4.

[10 marks]

c). Discuss the effects of sediment in dam, reservoir management and hydropower development. [8 marks]

END OF EXAMINATION PAPER