



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF CIVIL AND WATER ENGINEERING

HYDRAULIC DESIGN II

TCW 5201

Supplementary Examination Paper

July 2017

This examination paper consists of 2 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: NONE

Examiner's Name: Eng. A Chinyama

INSTRUCTIONS

1. Answer ALL questions
2. Each question carries 25 marks
3. Use of calculators is permissible

MARK ALLOCATION

QUESTION	MARKS
1.	25
2.	25
3.	25
4.	25
TOTAL	100

QUESTION ONE

- a. Draw and label a typical cross section through a zoned earthdam highlighting the measures taken to control seepage and embankment erosion. (10 marks)
- b. A rectangular concrete conduit is to be used as a culvert on a slope of 0.02. The culvert is 15m long and has a cross-section of 2m x 2m. If the tail water elevation is 1.8m above the crown at the outlet, determine the head water elevation necessary to pass a $10\text{m}^3/\text{sec}$ discharge. Assume $k_{ent}=0.5$, $n=0.012$, $C_d=0.62$. (15 marks)

QUESTION TWO

- a. Describe the types of discharge structures and indicate where they are most suitable. (5marks)
- b. Check a concrete gravity dam for stability against overturning and sliding given that it has an overall height of 30m, with a freeboard of 3m and a crest width of 4m. The dam has a 1V:4H upstream face slope and a 1V:2H 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. State any assumptions made clearly. (20 marks)

QUESTION THREE

- a. A suppressed rectangular weir is being used to measure flows in an irrigation canal. The weir is 5m wide and 2m high and under flood conditions, the upstream and downstream depths are measured as 2.5m and 2.3m respectively. Use all applicable formulae to estimate the range of possible flows over the weir under these conditions. Assess the reliability of your flow estimate. How can a more precise estimate of the flow rate be obtained? (15 marks)
- b. With aid of neatly labeled sketches describe how the venture flume is used to measure flow in an open channel. (10 marks)

QUESTION FOUR

- a. Describe typical impacts on the environment by dam construction projects and suggest mitigation measures for these. (10 marks)
- b. Why is site investigation essential in dam design and construction? Describe the processes involved in site investigation. (10 marks)
- c. Describe the factors that must be considered when siting a dam and choosing the type of dam to be constructed. (5 marks)