**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**
**FACULTY OF INDUSTRIAL TECHNOLOGY**
**BACHELOR OF ENGINEERING (HONS) DEGREE**
**DEPARTMENT OF CIVIL AND WATER ENGINEERING**
**PART V SECOND SEMESTER EXAMINATIONS- MAY 2011**

**HYDRAULIC DESIGN II – TCW5201**

**Instructions:**
Answer <u>All</u> Questions

Total marks:   100
Time:          3 hours

**QUESTION ONE**

a.  An earth dam is 30m high and has a 3m freeboard and a 3m crest width. The dam has a 1:2 upstream face slope and a 1:3 downstream face slope. The dam material has a permeability coefficient of 0.0001cm/ sec. Calculate the seepage per unit width using flownets.  State any assumptions made clearly.

**(15 marks**)

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

**QUESTION TWO**

a.  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 ($\mu$) 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)**

b.  Describe the middle third rule and explain its application in the design of concrete gravity dams.

**(5 marks)**

**QUESTION THREE**

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

**b.**  Water flows along a rectangular channel at depth of 1.30m when discharge is 8.74m$^3$/sec and the channel width is 5.5m. Ignoring energy losses, what is the minimum height of a rectangular broad crested weir if it is to function with critical depth on its crest?     **(10 marks)**

**c.**  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.** Discuss flood routing as an essential tool in the design of dams. What other factors and considerations should be made in dam design? **(10 marks)**

b. A reservoir has a capacity of 5 x $10^6$ m$^3$ and a drainage area of 190km$^2$. The average annual runoff from the water shed is 390mm, which brings in sediment quantity of 600m$^3$/km$^2$. Determine the time required to reduce the reservoir capacity to $1 \times 10^6$ m$^3$.

**(10 marks)**

c. Describe the types of spillways and indicate where they are most suitable.

**(5marks)**