TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

DIPLOMA IN BUILDING & CIVIL ENGINEERING

EBC 2304: HYDRAULICS

END OF SEMESTER EXAMINATION
SERIES: APRIL 2015
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*
This paper consists of **FIVE** questions. Answer any **THREE** questions of the **FIVE** questions
Maximum marks for each part of a question are as shown
Use neat, large and well labeled diagrams where required

This paper consists of **THREE** printed pages

Question One

a) Briefly explain the following:
- **(i)** Open channel
- **(ii)** Uniform flow
- **(iii)** Wetted perimeter **(6 marks)**

b) An open channel is V-shaped, each side sloping at 45° to the vertical, rate of flow $Q = 0.085 \text{m}^3$/s when depth is 250mm. Calculate slope of the channel take chezy constant = 50 in SI units **(8 marks)**

c) The cross section of an open channel is shaped in the form of a trapezium with side slopes 1:2. Assuming chezy constant C = 50 in SI units find discharge if depth of water is 1.55m and bed slopes at 1 in 800 **(6 marks)**

Question Two

a) Explain the term "Hydraulic mean depth" **(2 marks)**

b) Deduce the manning expression from Chezy formula **(4 marks)**

c) A trapezoidal canal has trapezoidal side slopes 1:2 and bottom width 2.6m. The canal discharges at a depth of 1.5m. If bed slopes at 1 in 3000 determine the discharge. Take manning coefficient n = 0.025 **(7 marks)**

d) A trapezoidal channel of bottom width 1.8m has side slope 1 vertical to 2 horizontal. The channel bed slopes at 1 in 2000 and discharge water a depth of 1.5m. Find flow velocity using Chezy, C expressed

$$C = \frac{87}{1 + K/\sqrt{M}}$$

as where K is Bazin coefficient = 1.3 **(7 marks)**

Question Three

a) Show that a rectangular channel discharges at maximum when its breadth is twice the depth **(8 marks)**

b) A trapezoidal channel conveys 150m³/min when its cross section is minimum. Its bed slopes at 1 in 500 and sides slope at 45°. Determine its dimensions: **(12 marks)**
(Take C = 56 in SI units)

Question Four

a) A sewer consists of circular x-section diameter 0.4m bed slopes at 1 in 200. Find maximum discharge if Chezy coefficient C = 50 in SI units **(6 marks)**

b) Explain the following terms as applied to open channels of non-uniform flow:
- **(i)** "Critical velocity"
- **(ii)** "Shooting flow" **(4 marks)**

c) (I) Show that critical depth for flow in a open channel triangular shaped with side slope 1:N when

$$D_C = \frac{4}{5} H$$

where H is specific energy

(II) Water flow in a channel of rectangular shape at 1.4m depth and at a velocity of 1.35m/s. Determine:
   (i) Specific energy for flow
   (ii) Critical depth
   (iii) Maximum discharge if the channel is 2.5m wide   **(10 marks)**

Question Five

a) Briefly explain:
   (i) The operation principle that apply to centrifugal pump
   (ii) The sterm specific speed of a centrifugal pump   **(8 marks)**

b) A centrifugal pump operating at 1200 rev/min provided the following results:

Discharge (m³/min)	0	3.5	8.0	12.5	17.0	21.5
Head (m)	21.5	21.2	20.6	18.5	13.1	0

The pump is connected to a 300mm diameter pipe 70m long and discharges to the atmosphere at a height of 10m above sump level. Taking f = 0.006 calculate the:
   (i) Required head and
   (ii) Determine graphically operating parameters for the system   **(12 marks)**