



Examination Date: 14th August 2013

TECHNICAL UNIVERSITY OF MOMBASA
**Faculty of Engineering &
Technology**

DEPARTMENT OF BUILDING & CIVIL ENGINEERING
DIPLOMA IN BUILDING & CIVIL ENGINEERING (DBCE 11)
DIPLOMA IN CIVIL ENGINEERING (DC 11)

EBC 2309: HYDRAULICS

END OF SEMESTER EXAMINATION
SERIES: AUGUST 2013
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

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

Question One

- a) Define the following types of flow:
- (i) Steady uniform flow
 - (ii) Steady non uniform flow **(6 marks)**
- b) A trapezoidal channel has a bed slope of 1:4000. The bed width is 8m and the depth of flow is 2.4m. The side slopes at 1:3 (H:V) and Manning's $n = 0.0197$. Determine:
- (i) Average flow velocity
 - (ii) Discharge in the channel **(10 marks)**
- c) Explain the importance of the following in open channel design:
- (i) Free board
 - (ii) Minimum permissible velocity **(4 marks)**

Question Two

A concrete lined sewer is 3.6m in diameter and has a bed slope of 1:600. If Chezy's $C = 50$, determine:

- (i) Maximum velocity
- (ii) Discharge at maximum velocity
- (iii) Maximum discharge
- (iv) Mean velocity at maximum discharge **(20 marks)**

Question Three

- a) Design a rectangular channel using the following data:
- (i) Flow is $50\text{m}^3/\text{s}$
 - (ii) Bed slope is 1:1000
 - (iii) Chezy's coefficient $C = 50$ **(10 marks)**
- b) The triangular gutter shown in figure 1 is conveying water at a rate of $0.04\text{m}^3/\text{s}$. If Manning's $n = 0.012$, determine the gradient of the channel. **(10 marks)**

Figure 1

Question Four

- a) A channel of rectangular section, 4m wide is discharging water at a rate of $6\text{m}^3/\text{s}$ with a velocity of 1.2m/s. determine:
- (i) The normal depth
 - (ii) Specific energy of the flowing liquid

- (iii) The critical depth
- (iv) The critical velocity

(10 marks)

b) Water is flowing at a rate of $7.2\text{m}^3/\text{s}$ in a rectangular channel 4.5m wide. If the depth of flow is 1.5m , determine:

- (i) The critical depth of flow
- (ii) Type of flow based on Froude's number
- (iii) Critical velocity

(10 marks)

Question Five

With the aid of sketches, briefly describe the working principle of:

- a)** A double acting reciprocating pump
- b)** A pelton wheel turbine

(10 marks)

(10 marks)