



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

((A Constituent College of JKUAT)

(A Centre of Excellence)

**Faculty of Engineering &
Technology in Conjunction with
Kenya Institute of Highways and
Building & Technology (KIHBT)**

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

HIGHER DIPLOMA IN BUILDING & CIVIL ENGINEERING

EBE 3117: HYDRAULICS

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2012

TIME: 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 (20 Marks)

- a) 1 litre of a certain liquid weighs 133.416KN. Determine SI units:
- i) Its unit weight
 - ii) Its mass density
 - iii) Its relative density
 - iv) The volume of 68kg of the liquid **(12 marks)**
- b) State **FOUR** assumptions made in deriving Bernoulli's equation. **(4 marks)**
- c) Water is flowing through a 5cm diameter pipe under a pressure of 294.3KN/m² (gauge) with a mean velocity of 2.0m/s. Find the total head at a cross section which is 5.0m above the datum. **(4 marks)**

Question Two (20 marks)

- a) Water having a coefficient of kinematic viscosity (ν) of $1.12 \times 10^{-6} \text{ m}^2/\text{s}$ and a mass density ρ of $1000\text{kg}/\text{m}^3$ flows at a mean velocity (v) of 1.75m/s through a 75mm diameter pipe whose Darcy's $f = 0.0025$. Determine:
- i) The Reynolds number
 - ii) Whether flow is laminar or Turbulent
 - iii) The energy loss that would occur in a 10m length of the pipe. **(8 marks)**
- b) Water is flowing through a tapering pipe AB, 100m long at a rate of 50l/s. Point A is 3.33m above B. The pipe diameter is 600mm at A and 300mm at B. If the pressure at A is 196.2KN/m², determining the pressure at B. (Ignore friction losses) **(12 marks)**

Question Three (20 marks)

- a) Water is flowing through a 200m long pipe at a rate of 0.2m³/s. If the head lost due to friction (h_f) is 4m, determine the diameter of the pipe assuming Chezy's $c = 50$. **(10 marks)**
- b) Two reservoirs are connected by a 300mm diameter pipe 400m long. The pipe entry and exit are sudden and Darcy's $f = 0.008$. Determine the difference in elevations of the water surfaces in the two reservoirs. **(10 marks)**

Question Four (20 marks)

- a) A triangular gutter with sided sloping at an angle of 30° to the vertical is conveying water at a rate of 0.04m³/s. If the depth of flow is 250mm and Chezy's $C = 52$, determine the bed slope. **(10 marks)**
- b) A rectangular channel is to be excavated in rock (Chezy's $C = 50$) to convey water at a rate of 12m³/s at an average velocity of 3m/s. Determine the dimensions of the best section. **(10 marks)**

Question Five (20 marks)

- a) A trapezoidal notch with bottom width of 0.4m has sides sloping at 45° to the vertical. The head causing flow is 20cm and $c_d = 0.62$ for the rectangular portion and $C_d = 0.60$ for the triangular portion. Determine the discharge... **(7 marks)**
- b) Define the following terms as applied to notches.
- i) Crest or sill
 - ii) Nappe or vein
- (4 marks)**
- c) Differentiate a “notch” from a “weir” in relation to:
- i) Material of construction
 - ii) Where applicable
 - iii) Size
- (6 marks)**
- d) State **THREE** advantages of a V-notch over a rectangular notch. **(3 marks)**