THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)
Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

Institutional Based Program

UNIVERSITY EXAMINATION FOR BACHELOR OF ENGINEERING IN BUILDING & CIVIL ENGINEERING

EBC 4320: HYDRAULICS

END OF SEMESTER EXAMINATION

SERIES: APRIL 2012
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*

This paper consists of **FIVE** questions in **TWO** sections **I** & **II**
Answer question **ONE (Compulsory)** and any other **TWO** questions
Maximum marks for each part of a question are clearly shown
This paper consists of **THREE** printed pages

SECTION I (Compulsory)

Question 1

a) Define the term steady flow (1/2 mark)

b) Express mathematically when the flow is unsteady (1½ marks)

c) Find the rate of flow for rectangular channel 7.5m wide for unform flow at a depth of 2.25m. The channel has a bed slope of 1 to 1000 and take Chezy's constant C = 55 (5 marks)

d) A centrifugal pump running at 750 r.p.m discharges water at 0.1m^3/s against a head of 10m at its best efficiency.
A second pump of the same homologous series, when working at 500 r.p.m, is to deliver water at0.05m^3/s at its best efficiency. What will be the design head of the second pump (6 marks)

e) It is required to design a channel to give a constant mean velocity of flow of 1.8m/s at all depths of flow. The lower position of the channel to carry the minimum discharge is rectangular and has the best proportion, the bottom width being 1.5m. Determine:
The channel bed slope (5 marks)

f) A 8m wide channel conveys $15m^3/s$ of water at a depth of 1.2m . Calculate:
(i) Specific energy of the flowing water (5 marks)
(ii) Critical depth, critical velocity and minimum specific energy (5 marks)
(iii) Froude number and comment on the flow (2 marks)

SECTION II (Answer any TWO questions)
Question 2

a) At an oil field near the shore, crude oil from well is stored in tanks near the shore from which it can be transferred to tanker ships. The oil normally flows by gravity under a head of 8.6m through a pipe 775m long and 200mm diameter; f = 0.03.
(i) Determine the rate of flow of oil (4 marks)
(ii) Estimate the rate of flow if it were increased by installing in the system a pump with the following characteristics (9 marks)

Q(L/Sec)	0	40	80	120	160	200
H(m)	1.8	12	11.6	10	8.4	6

b) During an experiment in a laboratory, 0.05m3 water flowing over a right-angled notch was collected in one minute. If the head of the sill is 50mm, calculate the coefficient of discharge of the notch (7 marks)

Question 3

a) Find the discharge through a trapezoidal notch which is 1.2m wide at the top and 0.50m at the bottom and is 0.4m in height. The head of water on the notch is 0.3m. Assume Cd for rectangular position = 0.62, while for triangular position = 0.6 (12 marks)

b) The specific energy for a 3m wide channel is to be 3Nm/N. Determine the maximum possible discharge (8 marks)

Question 4

a) Outline the type of turbines that are classified according to the head and quantity of water available (1 mark)

b) Define the term specific speed of a turbine (1 marks)

c) A pelton wheel is to be designed for the following specifications:

Power (brake or shaft)	=	9560kW
Head	=	350m
Speed	=	750rpw
Overall efficiency	=	85%

Jet diameter not to exceed $1/6^{th}$ of the wheel diam.
Calculate:

(i) The wheel diameter (7 marks)
(ii) Diameter of the jet (1 mark)
(iii) The number of jets required (10 marks)

Question 5

a) Explain how and when does a hydraulic jump occur (1 mark)

b) A 3.6m wide rectangular channel conveys $9.0m^3/s$ of water with a velocity of 6m/s.
   (i) Show that the condition of hydraulic jump to occur is met (6 marks)
   (ii) Calculate the height, length and strength of the jump (9 marks)
   (iii) What is loss of energy per kg of water (4 marks)