# THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

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

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

**UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN BUILDING & CIVIL ENGINEERING**

ECE 2312: HYDRAULICS

**END OF SEMESTER EXAMINATION**

SERIES: DECEMBER 2011

**TIME: 2 HOURS**

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

This paper consists of **FIVE** questions
Answer question **ONE (COMPULSORY)** from **SECTION A** and any other **TWO** questions from **SECTION B**
Maximum marks for each part of a question are clearly shown
This paper consists of **THREE** printed pages

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## SECTION A (COMPULSORY)

### Question 1 (20 marks)

a) Define the specific speed of a turbine and define the terms (2 marks)

b) Define Hydraulic efficiency($\eta_h$) (2 ½ marks)

c) Define Overall efficiency ($m^o$) (4 marks)

d) A Petton wheel having a mean bucket diameter of 1.2m is running at 1000rpm. The net head on the Petton wheel is 840m. If the side clearance angle is 15° and discharge through the nozzle is $0.12m^3/s$.
Calculate:

(i) Power available at the nozzle (1 ½ marks)
(ii) Hydraulic efficiency of the turbine (10 marks)

**SECTION B (Attempt any TWO questions)**

**Question 2 (20 marks)**

The water available for a Petton when is $4m^3/s$ and the total head from the reservoir to the nozzle is 250m. The turbine has two runners with two jets per runner. All the form jets have the same diameters. The pipe is 3km long. The efficiency of transmission through the pipeline and the nozzle is 91% and efficiency of each runner is 90%. The velocity coefficient of each nozzle is 0.975 and coefficient of friction '4f' for the pipe is 0.0045.

Calculate:

(i) The power developed by the turbine (7 marks)
(ii) The diameter of the jet; (6 marks)
(iii) The diameter of the pipe line (7 marks)

**Question 3 (20 marks)**

a) Calculate the specific speed of a pump whose operating characteristics are:
$Q = 44.16m^3/s$ and $N = 1200$ rpm
$H = 36.58M$
(5 marks)

b) At its rated capacity of 44.16m3/s this pump develops 36.58m of head when operating at 1459 rpm.
(i) Calculate the head (5 marks)
(ii) Discharge (5 marks)
(iii) Power required (5 marks)

**Question 4 (20 marks)**

a) Make short notes on:

(i) Breaking waves (2 marks)
(ii) Wind waves or wind generated waves (2 marks)
(iii) General coastal management strategies (2 marks)

b) A centrifugal pump impeller having external and internal diameters 480mm and 240mm respectively is running at 100rpm.

The rate of flow through the pump is $0.0576m^3/s$ and velocity of flow is constant and equal to 2.4m/s 180mm and 120mm respectively and suction and delivery heads are 6.2m and 30.2m of water respectively.

If the power required driving the pump is 23.3KW and the outlet vane angle is $45^o$.
Determine:
(a) Inlet vane angle (3 marks)
(b) The overall efficiency of the pump (7 marks)

(c) The manometric efficiency of the pump (4 marks)

**Question 5 (20 marks)**

a) A single-acting reciprocating pump, running at 50rpm. Delivers 0.00736m3/s of water. The diameter of the piston is 200mm and stroke length 300mm.
The suction and delivery heads are 3.5m and 11.5m respectively

Determine:

(i) Theoretical discharge (4 marks)
(ii) Coefficient of discharge (3 marks)
(iii) Percentage slip of the pump and; (2 marks)
(iv) The power required to run the pump (4 marks)

b) A single acting reciprocating pump operating at 120rpm has a piston diameter of 200mm and stroke of 300mm. The suction and delivery heads are 4m and 20 m respectively. The efficiency of both suction and delivery strokes is 75%.

Determine the power required by the pump (7 marks)