



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

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

**UNIVERSITY EXAMINATION FOR:  
BACHELOR OF SCIENCE IN CIVIL ENGINEERING**

ECE 2312: HYDRAULICS II

**SPECIAL/SUPPLEMENTARY EXAMINATION  
SERIES: FEBRUARY 2013  
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)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

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**Question One (Compulsory)**

- a) Define the specific speed of a turbine. (2 marks)
- b) Explain why and how causitation is undesirable. (3 marks)
- c) Give the mathematical expression of cavitation and explain the terms. (3 marks)
- d) Outline various measures of Coastal Erosion Controls. (16 marks)
- e) A pelton wheel having a mean diameter of 1.2m is running at 1000rpm. The net head on the Pelton wheel is 840m. If the side clearance angel is  $15^\circ$  and discharge through the nozzle is  $0.12\text{m}^3/\text{s}$ .

Determine:

- (i) Power available at the nozzle and (5 marks)
- (ii) Hydraulic efficiency of the turbine. (2 marks)

**Question Two**

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The water available for a Pelton wheel is  $4\text{m}^3/\text{s}$  and the total head from the reservoir to the nozzle is 250m. The turbine has two runners with two jets per runner. All the four 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 co-efficient of each nozzle is 0.975 and coefficient of friction '4f' for the pipe is 0.0045.

Determine:

- (i) The power developed by the turbine (9 marks)
- (ii) The diameter of the jet, and (4 marks)
- (iii) The diameter of the pipeline (7 marks)

### Question Three

The following data relate to a double overhung Pelton unit:

Output of generator	25000kW
Generator efficiency	93%
Effective head at the base of nozzle	300m
Pelton wheel efficiency	85%
Coefficient of velocity	0.97
Speed ratio	0.46
Jet ratio	12

Determine:

- (i) Size of jet (9 marks)
- (ii) Mean diameter of gunner (11 marks)

### Question Four

- a) Describe the types of head of a centrifugal pump. (4 marks)
- b) Outline the various losses of a centrifugal pump (2 marks)
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- c) Describe the mechanical efficiency  $\eta_m$  of a pump (6 marks)
- d) The impelles of a centrifugal pump having external and internal diameter 500mm and 250mm respectively, width at outlet 50mm and running at 1200rpm works against a head of 48m. The velocity of flow through the impelles is constant and equal to 3.0m/s. The vanes are set back at an angle of  $40^\circ$  at outlet.

Determine:

- (i) Inlet vane angle (5 marks)
- (ii) Manometric efficiency (3 marks)

### Question Five

- a) Describe with the aid of a diagram the small wave theory and give a fundamental assumption in the theoretical development of the theory. **(2 marks)**
- b) A centrifugal pump running at 800rpm is working against a total head of 20.2m.

The external diameter of the impeller is 480mm and outlet width 60mm. If the vanes angle at outlet is  $40^\circ$  and manometric efficiency is 70%,

Determine:

- (i) Flow velocity at outlet **(7 marks)**
- (ii) Absolute velocity of water leaving the vane **(2 marks)**
- (iii) Angle made by the absolute velocity at outlet with the direction of motion at outlet. **(5 marks)**
- (iv) Rate of flow through the pump. **(4 marks)**