



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

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

ECV 2304: HYDRAULICS

**END OF SEMESTER EXAMINATION**  
**SERIES: DECEMBER 2014**  
**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 of the **FIVE** questions

All questions carry equal marks

Maximum marks for each part of a question are as shown

Use neat, large and well labeled diagrams where required.

This paper consists of **THREE** printed pages

### Question One

- a) What is a “water wheel”? Explain the various forms of water wheels. **(5 marks)**
- b) With clear illustrations, distinguish clearly between an overshot water wheel and undershot water wheel. **(5 marks)**
- c) An undershot wheel is working under a head of 2.5m with a speed of 5 r.p.m. Find the diameter of the wheel, if its efficiency is 40%. Take coefficient of velocity as 0.98 and ratio of peripheral velocity of the wheel to the velocity of the jet as 0.46 **(10 marks)**

### Question Two

- a) List the SIX classifications of hydraulic Turbines. **(6 marks)**
- b) In a hydroelectric scheme, the distance between high level reservoir at the top of mountains and turbine is 1.6km and difference of their levels is 500m. The water is brought in 4 penstocks each of diameter of 0.9m connected to a nozzle of 200mm diameter at the end. Find:  
(i) Power of each jet and;  
(ii) Total power of Darcy’s coefficient of friction as 0.008  
Total power available at the reservoir falsing the value of Darcy’s coefficient of friction as 0.008 **(14 marks)**

### Question Three

- a) Outline any FIVE differences between an impulse turbine and a reaction turbine. **(10 marks)**
- b) A Kaplan turbine operating under a net head of 30 metres develops 25,000kw with an overall efficiency of 88%. The speed ratio 2.0 and flow ratio is 0.6. The hub diameter of the wheel is 0.36 times the outside diameter of the wheel. Find the diameter and speed of the turbine. **(10 marks)**

### Question Four

- a) Define the following efficiencies and losses of a reaction turbine:  
(i) Hydraulic efficiency  
(ii) Mechanical efficiency  
(iii) Overall efficiency **(6 marks)**
- b) A centrifugal pump is required to lift water to a total head of 40 metres at a rate of 50 litres. Find the power required for the pump, if its overall efficiency is 62% **(4 marks)**
- c) A centrifugal pump delivers 30 litres of water per second to a height of 18 metres through a pipe 90 metres long and of 100mm diameter. If the overall efficiency of the pump is 75%, find the power required to drive the pump. Take  $f = 0.012$ . **(10 marks)**

### Question Five

- a) Define an open channel **(1 mark)**
- b) A rectangular channel is 1.5metres deep and 6 metres wide. Find the discharge through channel, when it runs full. Take slope of the bed as 1:900 and Chezy's constant as 50 **(9 marks)**
- c) Water is flowing at the rate of 16.5 cubic metres per second in an earthen trapezoidal channel with bed width 9 metres, water depth 1.2 metre and side slope 1:2. Calculate the bed slope, if the value of C in the Chezy's formula be 49:5 **(10 marks)**