



# MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

P.O. Box 972-60200 – Meru-Kenya.

Tel: 020-2069349, 061-2309217. 064-30320 Cell phone: +254 712524293, +254 789151411

Fax: 064-30321

Website: www.must.ac.ke Email: info@must.ac.ke

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## University Examinations 2013/2014

THIRD YEAR, FIRST SEMESTER EXAMINATION FOR DIPLOMA IN CIVIL  
ENGINEERING

### ECV 0244: ENGINEERING HYDRAULICS I

DATE: APRIL 2014

TIME: 1 ½ HOURS

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**INSTRUCTIONS:** Answer question *one* and any other *two* questions

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#### QUESTION ONE – (30 MARKS)

- (a) Define the following terms:
- (i) Gradually varied flow
  - (ii) Piezometric head
  - (iii) Hydraulic gradient line
  - (iv) Normal depth
  - (v) Critical depth (5 Marks)
- (b) Name six storage zones in a reservoir. (3 Marks)
- (c) Name four dam safety monitoring parameters and state the defect associated with each. (4 Marks)
- (d) (i) State Mannings formula. (1 Mark)
- (ii) The cross-section of an open channel is a trapezium with a bottom width B of 3.6m and side slopes of 1 vertical to 2 horizontal. Find the channels' wetted perimeter (p) and hydraul mean depth (m). (4 Marks)
- (e) Distinguish between a dam and a reservoir. (3 Marks)
- (f) Name five differences between and impulse turbine and a reaction turbine. (5 Marks)
- (g) Find the wetted perimeter (p) for the following open channel cross-sections.
- (i) Semi-circular invert. (2 ½ Marks)
  - (ii) Circular culvert of diameter D. (2 ½ Marks)

**QUESTION TWO – (15 MARKS)**

(a) Using a well labelled diagram describe the working of an impulse turbine, hydro electric power plant. (7 Marks)

(b) A reservoir has the following areas enclosed by contours at various elevations. Determine the capacity of the reservoir between elevations of 200.00 to 300.00.

Elevation	200.00	220.00	240.000	260.00	280.00	300.00
Area of Contour (km <sup>2</sup> )	150.00	175.00	210.00	270.00	320.00	400.00

(4 Marks)

(c) Find the proportions of a rectangular channel of depth D and width B which will make the discharge a maximum for a given cross – sectional area. (4 Marks)

**QUESTION THREE – (15 MARKS)**

(a) Using a well labelled sketch, explain the storage zones of reservoir. (7 Marks)

(b) A 0.9m diameter pipe is to have a maximum discharge Q of  $0.7m^3/s$ . Calculate the required value of the bed gradient i. Take n in the manning formula to be  $\frac{1}{67}$ .

(8 Marks)

**QUESTION FOUR – (15 MARKS)**

(a) Using a well labelled diagram describe the working of a Kaplan Turbine. (8 Marks)

(b) Show that for a circular culvert of diameter D, the velocity of flow will be a maximum when the depth of flow-h at the centre is 0.81D. Use the Chezy formula. (7 Marks)