



# 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

SECOND YEAR, SECOND SEMESTER EXAMINATION FOR DIPLOMA IN CIVIL  
ENGINEERING

### EMC 0226: FLUID MECHANICS II

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) Differentiate between laminar and turbulent flow. (2 Marks)
- (b) Define the terms
- (i) Major energy losses
  - (ii) Minor energy losses in pipes. (2 Marks)
- (c) Find the head lost due to friction in pipe of diameter 200mm and length 60m, through which water is flowing at 2.5m/s using Darcy-weisbach formula ( $f = 0.005$ ). (4 Marks)
- (d) Using a neat sketch describe the operation of a single acting reciprocating pump. (2 Marks)
- (e) In relation to centrifugal pumps define the following term: manometric efficiency, mechanical efficiency, overall efficiency and volumetric efficiency. (4 Marks)
- (f) A six stage centrifugal pump delivers 120 litres per second against pressure of 5000KN/m<sup>2</sup>, if it rotates at 1450 rpm, calculate its specific speed. (4 Marks)
- (g) A piston of a single acting pump has a diameter 10cm and stroke 20cm, the pump is used to raise water to a height of 20m when running at 50rpm. Calculate the theoretical discharge and power required to run the pump if its efficiency is 90%. (6 Marks)
- (h) A liquid of viscosity 0.01 poise leaks through an horizontal slot 0.25mm deep, 100mm broad and 150mm long; the pressure difference is 34KN/m<sup>2</sup> calculate the rate of leakage. (4 Marks)
- (i) Define specific speed of a centrifugal pump. (2 Marks)

**QUESTION TWO – (15 MARKS)**

- (a) Viscous flow occurs between two parallel plates whose length is in the direction of flow is  $L$  and the distance apart is  $h$ , show that if the width of the plates is large compared with  $h$  and side friction can be neglected, the pressure drop in the direction of flow is

$$p = \frac{12\mu Lv}{h^2}. \text{ Where } \mu \text{ is the viscosity of the fluid and } v \text{ is the mean velocity.}$$

(10 Marks)

- (b) Oil of dynamic viscosity 0.687N/m-s is contained in a cylindrical tank of diameter 6m, leakage occurs at the circumferential seam which consists of a riveted lap joint, when oil pressure is 345KN/m<sup>2</sup>. If the plate overlap is 100mm and the effective gap between plates is 0.025mm; determine the rate of leakage when the effective circumferential length of the opening is 40%. (5 Marks)

**QUESTION THREE – (15 MARKS)**

- (a) A pipe 10cm diameter is 120cm long, the water flows in it at a velocity of 2.4m/s, the central 60m of the pipe is replaced by a pipe of diameter 20cm the change in section at both ends of the pipe is sudden, if  $f = 0.036$  and  $C_c = 0.62$ , determine the net head saving. (10 Marks)
- (b) Using Chezy's formula determine the head lost due to friction in a pipe 8cm diameter and length 35m, the velocity of flow is 2m/s, take Chezy's coefficient as 100. (5 Marks)

**QUESTION FOUR – (20 MARKS)**

- (a) A centrifugal pump delivers 40 litres per second of water to a height of 20m through a pipe 10cm diameter and 100 m long, if the overall efficiency of the pump is 75% find the power required to drive the pump, Assume  $f = 0.04$ . (8 Marks)
- (b) State three advantages of air vessels in reciprocating pumps. (3 Marks)
- (c) A simple acting reciprocating pump has a plunger diameter 30cm and stroke 20cm the speed of the pump is 30rpm and delivers 6.5 litres/second of water, calculate the coefficient of discharge and percentage slip of the pump. (4 Marks)