TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

EAR 2312: HYDRAULICS II

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2016

TIME: 2 HOURS

DATE: 15 Dec 2016

Instructions to Candidates

You should have the following for this examination

 -*Answer Booklet, examination pass and student ID*

 -*Drawing instruments.*

This paper consists of five questions.

Attempt question ONE (Compulsory) and any other TWO questions
 Do not write on the question paper.

QUESTION ONE [30 marks]

a) Describe the principle and working of a single reciprocating pump.

[5 marks]

b) With the aid of a sketch explain the function of air vessels in a reciprocating pump.

[5 marks]

c) A single acting reciprocating pump, running at 60 rpm delivers 0.004 cubic meters per second of water. The diameter of the piston is 150 mm and stroke length 250 mm. the suction and delivery heads are 4.5 m and 15.3 m respectively. Determine:
   i. Theoretical discharge
   ii. Coefficient of discharge
   iii. Percentage slip of the pump and.
   iv. Power required to run the pump

[10 marks]

d) A single acting reciprocating pump, having plunger diameter 125 mm and stroke length 300 mm is drawing water from a depth of 4 meters from the axis the cylinder at 24 rpm. The length and diameter of suction pipe is 9 meters and 75 mm respectively. If the barometer reads 10.3 m of water, find the pressure head on the piston:
   i. At the beginning and
   ii. At the end of the suction stroke.

[10 marks]

QUESTION TWO [20 marks]

a) Describe the classification of centrifugal pumps.

[5 marks]

b) Describe the principle and working of a centrifugal.

[5 marks]

c) The impeller of a centrifugal pump had an external diameter of 450 mm and internal diameter of 200 mm and it runs at 1440 revolutions per minute. Assuming a constant radial flow through the impeller at 2.5 m/s and that the vanes at exit are set back at an angle 25^0, determine:
   i. Inlet vane angle.
   ii. The angle, absolute velocity of water at exit makes with the tangent.
   iii. The work done per N of water.

[10 marks]

QUESTION THREE   [20 marks]

a)   Describe the classification of hydraulic turbines.

                                                                                                    [6 marks]

b)   Explain by eight points the differences between a reaction turbine and impulse turbine.

                                                                                                    [4 marks]

c)   A pelton wheel, having semi-circular buckets and working under a head of 200 metres is running at 700 rpm. The discharge through the nozzle is 850 litres per second and diameter of the wheel is 700 mm. Find:
   i.   Power available at the nozzle.
   ii.   Velocity of the jet.
   iii.   Hydraulic efficiency of the wheel, if coefficient of velocity is 0.98.

                                                                                                    [10 marks]

QUESTION FOUR   [20 marks]

a)   Describe five advantages of water turbines.

                                                                                                    [5 marks]

b)   A turbine is to operate under a head of 42 m at 500 rpm the discharge is 25m^3/s. If the overall efficiency is 89 per cent, determine:
   i.   Power generated
   ii.   Specific speed of the turbine.
   iii.   Type of turbine.

                                                                                                    [5 marks]

c)   A pelton wheel, working under a head of 600 metres, produces 15,600 kW at 520 rpm. If the efficiency of the wheel is 87 percent and coefficient of velocity is 0.98, Assuming suitable data, determine:
   i.   Discharge of the turbine.
   ii.   Diameter of the wheel.
   iii.   Diameter of the nozzle.

                                                                                                    [10 marks]

QUESTION FIVE   [20 marks]

a.   One of the waves in a tsumani has a period of 20 minutes and a height of 0.6 m at a point in the ocean where the depth is 3,800 m. Determine:
   i.   Celerity.
   ii.   Wave length.

                                                                                                    [5marks]

b.   Describe five non wind main causes of coastal water level fluctuations.

[5 marks]

c.   Describe the following types of impellers and state the function of each:
   - i.   Shrouded or closed impeller.
   - ii.   Semi – open impeller.
   - iii.   Open impeller.

[5 marks]

d.   A double acting reciprocating pump has a stroke of 400 mm and a piston of diameter 200 mm. the delivery and suction heads are 30 m and 6 m respectively including friction heads. If the pump is working at 45 rpm, find power required to drive the pump with 85 per cent efficiency.

[5 marks]