TECHNICAL 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

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 2013
TIME ALLOWED: 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 **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One (Compulsory)

a) List at least SIX comparison points between centrifugal and reciprocating pumps:

b) List the characteristics considered in classification of centrifugal pumps.

c) Derive from first principles the specific speed of a centrifugal pump in terms of the discharge of the pump.

d) What is the unit speed of a turbine?

e) Define specific speed of a turbine and show that it is given by the expression:

$$N_S = \frac{N\sqrt{P}}{H^{5/4}}$$

Question Two

A centrifugal pump discharges $0.02m^3$/sec against a head of 16.8m when the speed is 1500rpm. The diameter of the impeller is 0.32m and the power needed to drive the pump is 4.5KW. A geometrically similar pump 0.38m in diameter is to run at 1750rpm. Assuming equal efficiencies:

a) What head will be developed?
b) How much water will be pumped
c) What power will be developed **(20 marks)**

Question Three

A Pelton wheel develops 4500KW under a net head of 125m at a speed of 200rpm. Assuming $C_v = 0.98$, $\phi = 0.46$,
efficiency = 88% and the jet diameter – wheel diameter ratio of 1/9, determine:

(i) The flow required
(ii) The diameter of the wheel
(iii) The diameter and the number of jets required
(iv) The specific speed **(20 marks)**

Question Four

a) Consider the propagation of a very small wave on the surface of water in a channel. The water is otherwise at rest. Apply the energy equation to obtain the celerity of the wave

b) A floating object on the surface of the deep sea is observed to come on the crest 30 times per minute. Determine the wavelength and velocity of propagation of the wave. **(20 marks)**

Question Five

a) An existing pump having the tabulated characteristics is to be used to pump raw sewage to a treatment plant through a static lift of 20m. A uPVC pipeline 10km long is to be used. Allowing for minor losses $10\frac{V^2}{2g}$ totaling and taking an effective roughness e = 0.15mm because of sliming in the pipe, select a suitable commercially available pipe size to achieve a discharge of 60l/s; and calculate the power consumption.

Discharge (l/s)	0	10	20	30	40	50	60	70
Total head (m)	45	44.7	43.7	42.5	40.6	38.0	35	31
Overall efficiency %	-	35	50	57	60	60	53	40

(20 marks)