TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING & CIVIL ENGINEERING
UNIVERSITY EXAMINATION FOR:
SCHOOL BASED PROGRAMME

BACHELOR OF SCIENCE IN CIVIL ENGINEERING
ECE 2312 : HYDRAULICS II
END OF SEMESTER EXAMINATION
SERIES: AUGUST 2017
TIME: 2 HOURS
Pick Date Aug Pick Year

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.
-Question one carries 30 marks and the rest carries equal marks (15 marks)
- This paper consists of TWO printed pages

Do not write on the question paper.
Mobile phones are not allowed in the examination room.

QUESTION ONE (COMPULSORY) 30 Marks

a) Define the following terms
   i.   Net or effective head of a turbine
   ii. Hydraulic efficiency
   iii. Mechanical efficiency   (6marks)

b) Describe the two basic types of turbines   (4marks)
c) A turbine is to operate under a head of 25m at 2.00pm the discharge is 9m^3/s. if the overall efficiency is 90% determine.   (10 Marks)
   i.   Power generated
   ii. Specific speed of the turbine
   iii. Type of turbine

d) Given the following pump characteristic Q=44.16m³/s N=12rpm H=36.58

    i. Calculate the specific speed of the pump

    ii. At its rated capacity of 44.16m³/s this pump develops 36.58m of head when operating at 1450rpm. Calculate

    a) The head
    b) Discharge
    c) Power required   (10 marks)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION
QUESTION TWO (20 Marks)
A Pelton wheel is to be designed for the following specifications

Power	9560Kw
Head	350 meters
Speed	750rpm
Overall efficiency	85%
Jet diameter	not to exceed 1/6 of the wheel diameter

Calculate the following
a)   The wheel diameter
b)   Diameter of the jet and
c)   The number of jets required

Take CV=0.985; speed ratio 0.45   (20 marks)

QUESTION THREE (20 Marks)

A centrifugal pump impeller having an external and internal diameter 480mm and 240mm respectively is running at 100rpm. The rate of flow through the pump is 0.0576m³/s and velocity of flow is constant and equal to 2.4m/s; the diameter of the suction and deliver pipes are 180mm and 120mm respectively. If the power required to drive the pump is 23.3kW and the outlet vane angle is 45^0. Determine.
a) Inlet vane angle
b) Overall efficiency
c) Manometric efficiency of the pump   (20 marks)

QUESTION FOUR (20 Marks)

a. Define the term cavitation   (2marks)
b. Determine the maximum permissible elevation above tail water for the setting of a Francis turbine ($s = 80 \sigma c = 0.40$) to operate under a head of 16.764m at an elevation of 1524m with water temperature at 60^0F   (8 marks)

c. A pump with critical value of $\sigma c = 0.1$ is to pump against a head of 150m. The barometric pressure is 98.KN/m² abs and the vapor pressure is 5.2KN/m² abs. Taking the friction losses in the intake to

be 1.5m, find the maximum allowable height of the pump relative to the water surface at intake.
(10 Marks)

QUESTION FIVE (20 Marks)

a) Describe the suction pipe (4 marks)

b) A centrifugal pump is to discharge $0.118m^3$/s at a speed of 1450rpm against a head of 25m. The impeller diameter is 250mm, its width at outlet is 50mm and manometric efficiency is 75%. Determine the vane angle at the outer periphery of the impeller. (16 marks)