TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION COUNCIL (TVET CDACC)

Qualification Code	**:**	071606T4MCT
Qualification	**:**	Mechatronics Technician Level 6
Unit Code	**:**	ENG/OS/MC/CC/07/6
Unit of Competency	**:**	Apply Fluid Mechanics Principles

WRITTEN ASSESSMENT

INSTRUCTIONS TO CANDIDATE

1. You have **THREE** hours to answer all the questions.
2. Marks for each question are indicated in the brackets.
3. The paper consists of **TWO** sections: A and B.
4. Do not write on the question paper.
5. A separate answer booklet will be provided.
6. You are required to have a scientific calculator in this assessment.

This paper consists of FOUR (4) printed pages

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

SECTION A: (40 MARKS)

1. List two reciprocating pumps classified according to:
   a. Contact of water (2 Marks)

   b. Number of cylinders provided (2 Marks)

2. What are the two methods of performing dimensional analysis? (2 Marks)

3. State three properties of a fluid (3 Marks)

4. Outline four main parts of a centrifugal pump? (4 Marks)

5. State three types of impellers found in centrifugal pump? (3 Marks)

6. State the principle of homogeneity in dimensional method? (2 Marks)

7. Outline two important functions of a multistage pump (2 Marks)

8. What are the three fundamental dimensions of model analysis? (3 Marks)

9. State two methods of calculating major losses in fluids moving through pipes (2 Marks)

10. Name the three efficiencies of a centrifugal pump (3 Marks)

11. Outline four factors which affect viscosity in fluids (4 Marks)

12. State four types of flows in fluid mechanics (4 Marks)

13. List four advantages of reciprocating pump over centrifugal pumps (4 Marks)

SECTION B: (60 MARKS)

(Answer Any THREE (3) Questions this section)

14.

a. Define 'slip' as used in reciprocating pumps (1 Mark)

b. State the reasons that causes negative slip in reciprocating pumps (3 Marks)

c. The cylinder bore diameter of a single-acting reciprocating pump is 150 mm and its stroke is 300 mm. the pump runs at 50 r.p.m. and lifts water through a height of 25 m. the delivery pipe is 22 m long and 100 mm in diameter. Find the theoretical discharge and the theoretical power required to run the pump. If the actual discharge is 4.2 litres/s, find the percentage slip. Also determine the acceleration head at the beginning and middle of the delivery stroke. (16 Marks)

15.

a. A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 r.p.m. works against a total head of 40 m. the velocity of flow through the impeller is constant and equal to 2.5 m/s. the vanes are set back at an angle of 40^{o} at outlet. If the outer diameter of the impeller is 500 mm and the width at outlet is 50 mm, determine:

i. Vane angle at inlet
ii. Work done by the impeller on water per second
iii. Manometric efficiency

(14 Marks)

b. An oil of specific gravity of 0.7 is flowing through a pipe of diameter 300 mm at the rate of 500 litres/s. find the head loss due to friction and power required to maintain the flow for a length of 1000 m. take v=0.29 stokes (6 Marks)

16.

a. A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m of its length from tank, the pipe is 150 mm diameter is suddenly enlarged to 30 mm. the height of water of water level in the tank is 8 m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow. Take f=0.01 for both sections of the pipes. (16 Marks)

b. List four factors that affect the fluid flow (4 Marks)

17.

a. Find the head loss due to friction in a pipe of diameter 300 mm and length 50 m, through which water is flowing at a velocity of 3 m/s using:
   i. Darcy formula
   ii. Chezy's formula; for which C=60

(10 Marks)

b. A crude oil of viscosity 0.97 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 100 mm and of length 10 m. calculate the difference of pressure at the two ends of the pipe, if 100 kg of the oil is collected in a tank in 30 seconds.

(10 Marks)