



KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR**

**THIRD YEAR FIRST SEMESTER
MAIN EXAMINATIONS**

**FOR THE DEGREE OF B.SC (RENEWABLE ENERGY AND BIOFUELS
TECHNOLOGY)**

COURSE CODE: REN 312

COURSE TITLE: FLUID MACHINERY

DATE: 15/12/2022

TIME: 9:00-11:00AM

INSTRUCTIONS TO CANDIDATES

TIME: 2 Hours

Answer question ONE and any TWO of the remaining

KIBU observes ZERO tolerance to examination cheating

Question One (Compulsory)

- a) What is meant by the term "fluid machinery"? (2 marks)
- b) Distinguish between driving machine and driven machine. (4 marks)
- c) What are the primary differences between fans, blowers, and compressors? Briefly explain in terms of pressure rise and volume flow rate. (4 marks)
- d) List THREE main categories of dynamic pumps. (3 marks)
- e) Describe the principle of operation of reciprocating pumps. (5 marks)
- f) Describe the following heads as used in centrifugal pumps. (2 marks)
- i) Delivery head (2 marks)
 - ii) Eulers head (2 marks)
- g) Name and briefly describe the differences between the two basic types of dynamic turbine. (5 marks)
- h) List the main parts of a centrifugal compressor. (3 marks)

Question Two

- a) Elaborate **FOUR** advantages of positive displacement pumps over non-positive displacement pumps. (4 marks)
- b) Describe any **FOUR** types of fans. (16 marks)

Question Three

- a) State the main parts of a reciprocating pump. (6 marks)
- b) A single acting reciprocating pump running at 50 r. p. m delivers $0.01\text{m}^3/\text{s}$ of water. The diameter of piston is 200mm and stroke length 400mm. calculate; (14 marks)
- i) theoretical discharge.
 - ii) coefficient of discharge.
 - iii) slip and percentage of slip.

Question Four

- a) A centrifugal pump discharge $0.118\text{m}^3/\text{s}$ at a speed of 1450 r. p. m against a head of 25m, with impeller outer diameter of 250mm. Its width at the outlet is 50mm and manometer efficiency of 75%. Determine the vane angle at outer periphery of the impeller. (12 marks)
- b) Describe the losses experienced in centrifugal pumps. (8 marks)

Question Five

- a) A Kaplan turbine develops 24647.6kW power at an average head of 39m. Assuming a speed ratio of 2 and flow ratio = 0.6; diameter of the boss = 0.35 times the diameter of runner and an $\eta_o = 90\%$. Calculate the diameter, speed and specific speed of the turbine. (10 marks)
- b) A centrifugal compressor running at 1500 r. p. m has internal and external diameters of the impeller as 250mm and 500mm respectively. The blades angles at inlet and outlet are 18° and 40° respectively. The air enters the impeller radially. Determine the work done by the compressor per kg of air and degree of reaction. (10 marks)