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**UNIVERSITY EXAMINATIONS  
2023/2024 ACADEMIC YEAR**

**THIRD YEAR FIRST SEMESTER  
MAIN EXAMINATION**

**FOR THE DEGREE OF BACHELOR OF SCIENCE IN  
RENEWABLE ENERGY AND BIO FUELS TECHNOLOGY**

**COURSE CODE: REN 312**

**COURSE TITLE: FLUID MACHINERY**

**DURATION: 2 HOURS**

**DATE: 6/12/2023**

**TIME: 9:00-11:00AM**

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**INSTRUCTIONS TO CANDIDATES**

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

QUESTION ONE ( 30 MARKS )

(a) (a) Define the following as applied in Fluid machinery:

(i) Axial air FAN

(ii) pump

(iii) State TWO applications of 1(i) and (ii)

(6 marks)

(b) Explain the following causes of instability of an Axial flow Fan

(i) Stalling

(ii) Fan surge

(6 marks)

(c) Sketch the following types of pumps

(i) Lobe

(ii) Gear

(iii) Centrifugal

(6 Marks)

(d). A plate is 0.25mm distant from a fixed plate. It moves at a velocity of 60cm/s and requires a force of 0.002 Kn /m<sup>2</sup> to maintain the speed. Determine the fluid viscosity between the plates

(6 marks)

e(a) (i) Sketch the performance curve for an axial flow Fan

(i) State the significance of point 'S'

(6marks)

QUESTION TWO (20 MARKS)

(a) With the aid of sketches, describe the three Fan Laws

(12 MARKS)

(b) Differentiate between an Axial flow fan and a centrifugal flow Fan

(4 MARKS)

(c) Determine the Pumping power for water to a height of 10 m at a flow rate of  $1\text{m}^3/\text{hour}$ .

(4 marks)

QUESTION THREE (20 MARKS)

Applying Slip stream theory and Bernoulli's principle on a converging disk ,

Show that the relationship between the Diameter at exit and inlet of a propeller disk is given by the following expression:

$$D_s^2 = \left\{ \frac{1+2a}{1+2a} \right\} D_i^2$$

(20 marks)

QUESTION FIVE (30 MARKS)

(a) . Sketch the following types of Axial Flow Fans

(i) Tube axial

(ii) Propeller

(6 marks)

(b) Sketch the following types of pumps

(i) centrifugal

(ii) screw

(6 marks)

© With the aid of sketches differentiate between an Axial flow fan and a centrifugal flow Fan

(6 marks)

(d) Sketch the pump performance curves for a centrifugal pump with backward inclined blades.

(6 marks)

(e) With the aid of sketches describe the working principal of the following types of compressors

(i) Reciprocating

(ii) Rotary screw

( 6 marks)