



# KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS  
2017/2018 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER  
MAIN EXAMINATIONS

FOR THE BACHELOR OF RENEWABLE ENERGY AND BIOFUELS  
TECHNOLOGY

**COURSE CODE: IPT 321**

**COURSE TITLE: FLUID MACHINERY**

**DURATION: 2 HOURS**

**DATE: 16/10/ 2018 TIME: 9 – 11Am**

---

## **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.

This paper consists of **3** printed pages. Please Turn Over



**QUESTION ONE (30 MARKS)**

- a) Define the following terms:
- i. Induced draft
  - ii. Forced draft (2 marks)
- b) Explain the advantage of the forward curved blades in the operation of a centrifugal fan (2 marks)
- c) i) With the aid of a labelled diagram, describe the propeller fan (5 marks)
- ii) State four applications of the propeller fan (2 marks)
- d) Explain the following terms:
- i. Fan static pressure
  - ii. Fan velocity pressure
  - iii. Fan total pressure (6 marks)
- e) i. Differentiate between single acting and double - acting pumps (4 marks)
- ii. A single-acting reciprocating pump has a plunger of diameter 300mm and stroke of 200mm. If the speed of the pump is 30 rpm and it delivers 6.5litres/sec of water, find the coefficient of discharge and the percentage slip of the pump (9 marks)

**QUESTION TWO (20 MARKS)**

A centrifugal fan has a circular inlet duct of 0.45m diameter and a rectangular outlet duct of 0.45m by 0.375m. The static pressure at the fan inlet is -12.5mm of water and the static pressure of the fan outlet is 25mm of water when the fan delivers  $115\text{m}^3/\text{min}$  and absorbs 1Kw.

Assuming standard air density in both ducts and compressibility factor as 1, determine:

- a) Total pressure of fan inlet and outlet
- b) Fan total pressure and fan static pressure (20 marks)

**QUESTION THREE (20 MARKS)**

- a) State the function of the following parts of a centrifugal pump
  - i. Impeller
  - ii. Pump casing
  - iii. Suction pipe
  - iv. Prime mover (6 marks)
- b) Draw a neat sketch of a Pelton wheel and name four main parts (6 marks)
- c) A Pelton wheel develops 2000KW under a head of 100 metres, and with an overall efficiency of 85%. Find the diameter of the nozzle, if the coefficient of velocity for the nozzle is 0.98 (8 marks)

**QUESTION FOUR (20 MARKS)**

- a) State two applications of compressors (2 marks)
- b) Define the following terms:
  - i. Discharge pressure
  - ii. Compressor capacity (2 marks)
- c) Give a description of the working principle of a single stage reciprocating air compressor (5 ½ marks)
- d) Outline four advantages of multi-stage compression for air (4 marks)
- e) i. Describe the difference between gas transfer vacuum pumps and gas binding pumps (1 ½ marks)  
  
ii. State two applications of vacuums (2 marks)
- f). Differentiate between a centrifugal compressor and an axial flow compressor (3 marks)

**QUESTION FIVE (20 MARKS)**

- a) What is a reaction turbine? (2 marks)
- b) Outline two differences between a reaction turbine and an impulse turbine (4 marks)
- c) Name the three characteristics of turbines (3 marks)
- d) State four sets of conditions that may be used in the plotting of fan characteristics (4 marks)
- e) Describe how the operating point of a fan is determined (7 marks)