



TECHNICAL UNIVERSITY OF MOMBASA

School of Engineering and Technology

Department of Electrical and Electronic Engineering

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING

EEE 4421: HYDRAULICS AND PNEUMATICS

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2024

TIME: 2 HOURS

DATE: AUGUST 2024

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **five** Questions; Question ONE is compulsory. In addition attempt any Other TWO Questions.

Do not write on the question paper.

Question ONE (Compulsory 30 marks)

- a) With the aid of diagram explain the elements of a pneumatic system [7marks]
- b) State any four advantages and four disadvantages of pneumatic systems [8 marks]
- c) A tangential turbine develops 7200 hp at 200 rpm under a head of 790 m at an efficiency of 82%. If the speed factor is 0.46, determine;
 - (i) the wheel diameter, flow, unit speed, unit power, unit flow, and specific speed,
 - (ii) the speed, power, and flow under a head of 529 m
 - (iii) the size of the wheel required to develop 3800 hp under a 600 m head, and for a turbine having the same design,
 - (iv) the speed and rate of discharge for (iii)

[15 marks]

Question TWO (20 marks)

- a) with the aid of a diagram explain the principle of operation of a diaphragm compressor [8 marks]
- b) Determine the volumetric flow to use in sizing a compressor to meet the following suction requirements:

Weight flow -- 425 lb/min dry air

Inlet pressure = 14.7 psia ambient air

Inlet temperature = 90° F

Inlet relative humidity - 95 %

[12 marks]

Question THREE (20 marks)

a) With the aid of a diagram explain the principle of operation of adsorption type dryer

[12 marks]

b) An impulse wheel at best speed produces 93 kW under a head of 64 m. determine;

(i) by what percent the speed should be increased for an 88-m head

(ii) power would result in (i) assuming equal efficiencies

[8 marks]

Question FOUR (20 marks)

a) (i) State any four functions of compressed air aftercooler

(ii) Explain the principle of operation of water cooled pipeline aftercooler

(iii) State any two advantages any two disadvantages of water cooled pipeline aftercooler

[10 marks]

b) A centrifugal pump discharged 0.019 m³/s against a head of 16.8 m when the speed was 1500 rpm. The diameter of the impeller was 320 mm, and the brake power was 4.5 kW. A geometrically similar pump 380 mm in diameter is to run at 1750 rpm. Assuming equal efficiencies, determine the

(i) Head developed

(ii) Amount of water pumped, and

(iii) Brake power developed

[10 marks]

Question FIVE (20 marks)

a) With the aid of diagrams explain construction and principle of operation of a single cylinder type compressor

[10 marks]

b) A single-stage double acting compressor has the following parameters;

Bore: 6 cm.

Stroke: 12 cm.

Speed: 300 rpm

Rod diameter: 2.5 cm.

Clearance: 12%

Gas: CO₂

Inlet pressure: 1720 psia

Discharge pressure: 3440 psia

Inlet temperature: 115°C

Determine the

(i) suction capacity,

(ii) horsepower,

(iii) discharge temperature,

(iv) piston speed

[10 marks]