



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: NOVEMBER 2024

TIME: 2 HOURS

DATE: NOVEMBER 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 hydraulic system [7marks]
- b) State any four advantages and four disadvantages of hydraulic systems [8 marks]
- c) Determine the parameters necessary to do a preliminary sizing of a single-stage diaphragm compressor for a hydrogen gas application at the following conditions:
 - Gas: H₂
 - Inlet Pressure: 365 psi
 - Inlet Temperature: 68°C
 - Discharge Pressure: 910 psi
 - Capacity Required: 53 N/hr
 - Gas Density at Inlet Conditions: 0.1279 N/m³[15 marks]

Question TWO (20 marks)

- a) with the aid of a diagram explain the principle of operation of a multi stage piston compressor with inter cooler

[8 marks]

- b) A directional control valve is used to control an airpower machine. This machine consumes air 75 SCFM at 80 psig. The pressure drops across the valve is 10 psig. Calculate the valve flow factor if the air temperature is 70°C

[12 marks]

Question THREE (20 marks)

- a) With the aid of a diagram explain the principle of operation of refrigerated 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

- (i) the head developed
- (ii) the amount of water pumped,
- (iii) the brake power developed

[10 marks]

Question FIVE (20 marks)

- a) With the aid of diagrams explain construction and principle of operation of a single rotary vane 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 psi
Discharge pressure: 3440 psi
Inlet temperature: 115°C

Determine the

- (i) suction capacity,
- (ii) horsepower,
- (iii) discharge temperature,
- (iv) piston speed

[10 marks]