



# TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

**UNIVERSITY EXAMINATION FOR:**

**BSME/BEME Y4S2**

**EMG 2418 : PNEUMATICS AND ELECTRO-HYDRAULICS**

**END OF SEMESTER EXAMINATION**

**SERIES: APRIL 2016**

**TIME: 2 HOURS**

**DATE: 16 May 2016**

## Instructions to Candidates

You should have the following for this examination

- Answer Booklet, examination pass and student ID
- scientific calculator
- Drawing instruments

This paper consists of **FIVE** questions. Attempt any **THREE** questions.

**Do not write on the question paper.**

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## **Question ONE**

- (a) (i) State the **THREE** functions of an air receiver in a pneumatic system  
(ii) Explain the circumstance under which a pressure reducing valve is used in a compressed air system  
(4<sup>1</sup>/<sub>2</sub> marks)
- (b) Explain the function of **FOUR** mountings fitted in air receive,  
(4 marks)
- (c) A machine requires 128m<sup>3</sup>/s of free air from a compressor that delivers air at 8 bar. A branch line for an equipment that operates with air at a pressure of 5 bar is connected at a point where pressure is 7 bar. If the allowable pressure drop is 12 mbar/m in all steel pipe, using the nomograms on tables 1,2 and 3, determine:
- (i) the capacity of the required receiver,
  - (ii) the size of pressure reducing valve to be fitted on the branch,
  - (iii) the size of steel pipes laid,

- (iv) the size of an equivalent nylon pipe that would be fitted in branch line to supply a machine tool with  $7.5 \text{ dm}^3/\text{s}$  of air at 5 bar.

(11<sup>1</sup>/<sub>2</sub> marks)

### Question TWO

- (a) (i) Outline any FOUR sectors where electro-hydraulic systems are used  
 (ii) State the THREE advantages of electrical or electronics controls in hydraulic,  
 (7 marks)
- (b) With the aid of a schematic diagram describe the TWO principal sub-assemblies in an electro-hydraulic system,  
 (7 marks)
- (c) (i) Illustrate a control loop system of a hydraulic lifting cylinder,  
 (ii) Use a standard system to designate the control elements in the control loop in c (i).

(7 marks)

### Question THREE

- (a) State the THREE reason for regulating air in pneumatic systems,  
 (3 marks)
- (b) List any FOUR specifications that must be clearly indicated on the surface of air receiver,  
 (4 marks)
- (c) A load of mass 750 kg is to be lifted to a distance of 800 mm and the available air pressure at point of use is 7 bar. If the load is to be moved the full distance in 3 seconds and the cylinder is to make four complete cycles per minute and allowing for 40% losses in the cylinder, calculate:  
 (i) the diameter of the air cylinder required  
 (ii) the actual air consumption per minute by the cylinder,  
 (iii) the rate of air consumption .

(14 marks)

Table 4: Standard Air Cylinder

Bore (mm)	80	100	125	140	160
Rod Diameter (mm)	22	26	30	30	36
Stroke (mm)	Upto 750	Upto 750	25-1000	30-1000	35-1200

### Question FOUR

- (a) Outline the FOUR basic logic operations available for use in electro-hydraulic,  
(4 marks)
- (b) With the aid of a diagram briefly describe an AND function and the equivalent electrical circuit diagram that can be used in an electro-hydraulic system.  
(7 marks)
- (c) (i) Outline the terminal designation for electrical switching elements,  
(ii) Illustrate a typical circuit part list as used in electro-hydraulics system.  
(9 marks)

### **Question FIVE**

- (a) State any TWO installation requirements for each of the following pneumatics component:
- (i) Piping
  - (ii) Cylinder
  - (iii) Compressor
- (b) Draw a maintenance schedule that outlines TWO tasks each carried out on pneumatics systems during the following period:  
(6 marks)
- (i) Daily
  - (ii) Weekly
  - (iii) Monthly
- (6 marks)
- (c) For each of the following failure symptoms in compressed air system, state the TWO most likely causes and their remedies:
- (i) Regulator cannot reach the set point
  - (ii) Erratic cylinder action
- (8 marks)