



**UNIVERSITI KUALA LUMPUR**  
**MALAYSIA FRANCE INSTITUTE**

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**FINAL EXAMINATION**  
**SEPTEMBER 2014 SESSION**

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**SUBJECT CODE** : FMD21203  
**SUBJECT TITLE** : PNEUMATICS AND HYDRAULICS  
**LEVEL** : DIPLOMA  
**DURATION** : 2.0 PM – 4.30 PM  
(2.5 HOURS )  
**DATE / TIME** : 11 JANUARY 2015

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**INSTRUCTIONS TO CANDIDATES**

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1. Please read the instructions given in the question paper **CAREFULLY**.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This question paper consists of **TWO (2)** sections. Section A and B. Answer all questions in Section A. For Section B, answer **TWO (2)** question only.
6. Answer all questions in English.

**SECTION A (Total: 60 marks)****INSTRUCTION: Answer ALL questions.****Please use the answer booklet provided.****Question 1**

- a) State two advantages of using pneumatics energy. (4 marks)
- b) Name two types of air dryer used in preparing compressed air. (4 marks)
- c) State the function of 'end cushioning' that found in pneumatic cylinders. (2 marks)
- d) Name two of the components that made up the hydraulic power supply unit. (4 marks)
- e) State the main criteria used to select the right viscosity of hydraulic oil. (2 marks)
- f) Name the gas that used to charge the accumulators, and give one reason why it is chosen. (4 marks)

**Question 2**

a) Draw the symbol for the following pneumatic and hydraulic components:

i) 3/2- way roller lever valve

(1 mark)

ii) 4/3-way directional control valve, mid-position all ports closed

(1 mark)

iii) Pilot control check valve

(1 mark)

iv) Adjustable pressure regulator

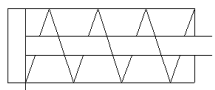
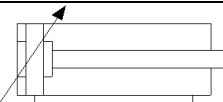
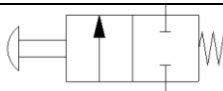
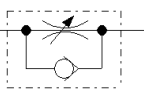
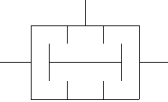
(1 mark)

v) Hydraulic motor

(1 mark)

b) Name the component of the following symbols:

(5 marks)

i)	
ii)	
iii)	
iv)	
v)	

c) Match the components of the pneumatic and hydraulic below with its function accordingly. Please refer to **Table 1**.

(10 marks)

**Table 1**

<b>Component</b>	<b>System</b>	<b>Function</b>
Service Unit	Pneumatics	To perform forward and reverse motion with pressurized
Shuttle Valve	Pneumatics	To set the constant flow so that the piston speed is variable
Accumulator	Hydraulics	To condition the air so that it is clean, regulated at certain pressure and enrich with oil mist
Flow control valve	Hydraulics	Also known as OR gate which provide alternative signal input
Double acting cylinder	Hydraulics	As a power back up for the system when the main power failure

**Question 3**

- (a) A double-acting pneumatic cylinder travels forward and reverse. Piston diameter is 0.05 m, piston rod diameter is 0.02 m, at compressed air supply pressure of  $p = 600$  kPa.
- i) Calculate the effective area of piston side and piston rod side. ( $A$  in  $m^2$ )  
(5 marks)
- ii) Find the forward force,  $F_f$  and reverse force,  $F_r$  exert on the piston rod during forward and reverse movement. ( $F$  in  $N$ )  
(5 marks)
- (b) A gear pump in hydraulic power unit delivers a flow rate of  $Q = 12 \times 10^{-3} \text{ m}^3/\text{min}$ . It pressurizes a single-acting cylinder with 0.2 m diameter piston.
- i) Calculate piston area of the single acting cylinder,  $A$  (in  $m^2$ )  
(5 marks)
- ii) Find the forward speed  $v$  (in  $m/\text{min}$ ) of the piston.  
(5 marks)

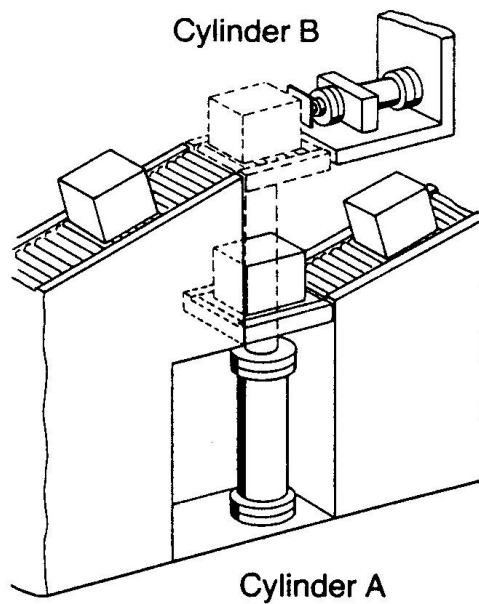
**SECTION B (Total: 40 marks)**

**INSTRUCTION: Answer TWO (2) questions ONLY.**

**Please use the answer booklet provided.**

**Question 4**

An automation system consists of two double acting cylinders (*Figure 1*), packages arriving on a roller conveyor are lifted by a pneumatic cylinder A and pushed onto another conveyor by a second cylinder B. Cylinder B may then perform a return stroke only after cylinder A has reached the rear end position. From the above operation you are required to;

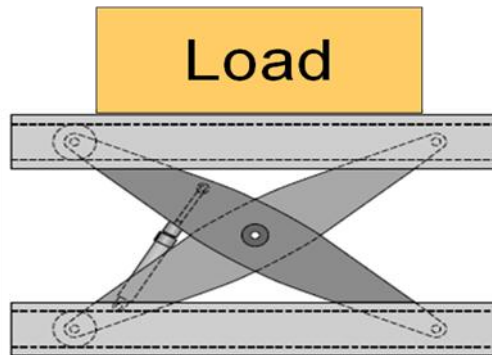


*Figure: 1*

- (a) Draw the flow chart showing step by step of the complete operation. (4 marks)
- (b) Make the list of components required for the system. (6 marks)
- (c) Design the pneumatic circuit. (10 marks)

**Question 5**

A scissor lift (*Figure: 3*) is used to lift heavy loads to the platforms of varying heights. The loaded lift must be able to **remain at given height** over a long period of time. The lift is powered by a double acting cylinder.



*Figure: 3*

- (a) Design a **hydraulics** circuit diagram for the above operation by using the components listed in *Table 2*.

(10 marks)

*Table 2*

Description	Quantity
Double acting cylinder	1
4/3-way direction control valve, mid position closed	1
Pilot controlled check valve	1
Pressure relief valve with pressure gauge	1
Hydraulic Power unit	1

- (b) Calculate the minimum pressure required,  $P$  (*in  $N/m^2$* ) to lift a total load of 100 kN with cylinder size 0.15 m diameter.

(5 marks)

- (c) Calculate the suitable piston diameter to be used if the total load to be lifted is 150 kN using pressure of 4000 kPa. (*diameter in m*)

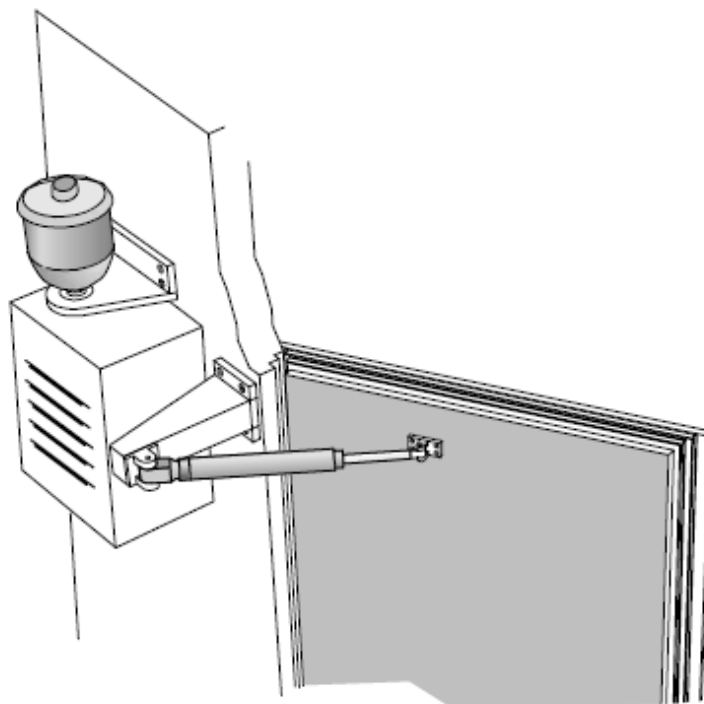
(5 marks)

**Question 6**

A heavy cold-storage door is opened and closed by a hydraulic cylinder as shown in Figure 4 below. A hydraulic accumulator is to be installed as back up energy in case of an electrical power failure. This will permit the cold-storage door to be opened and closed a number of times. A hand lever valve is to be used to activate the cylinder. This valve should be connected up in such a way that the piston rod is extended with the valve in its normal position. No provision will be made here for the safety cut-out which is essential to prevent persons from becoming trapped in the door. This cut-out function is normally provided by an electrical control device for the hydraulic system.

Design the hydraulic circuit.

(20 marks)



*Figure: 4*

**END OF QUESTION**