UNIVERSITI KUALA LUMPUR

MALAYSIA FRANCE INSTITUTE

FINAL EXAMINATION

SEPTEMBER 2013 SESSION

SUBJECT CODE	**:**	**FMD 21203**
SUBJECT TITLE	**:**	**PNEUMATICS AND HYDRAULICS**
LEVEL	**:**	**DIPLOMA**
DURATION	**:**	**2.5 HOURS**
DATE / TIME	**:**	

INSTRUCTIONS TO CANDIDATES

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.

THERE ARE 6 PRINTED PAGES OF QUESTIONS EXCLUDING THIS PAGES

SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

(a)   State the two gases which are the main constituents of air.

(2 marks)

(b)   Describe the direction of motion of pneumatic cylinders

(2 marks)

(c)   State TWO (2) examples of application for single-acting cylinders.

(2 marks)

(d)   Explain why is the shuttle valve also called an OR valve?

(2 marks)

(e)   Explain why is the two-pressure valve also called an AND valve?

(2marks)

(f)   Write FOUR (4) values affect the pressure drop in the hydraulic system?

(2 marks)

(g)   State advantage does the use of a by-pass system offer?

(2 marks)

(h)   Explain what is meant by "stick-slip" in the hydraulic system?

(2 marks)

(i)   Explain what is the purpose of hydraulic motors?

(2 marks)

(j)   Describe what is a differential cylinder and what advantages does it offer in hydraulic circuit?

(2 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 from the following symbols:

    i)   (1 mark)

    ii)   (1 mark)

    iii)   (1 mark)

    iv)   (1 mark)

    v)   (1 mark)

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

(10 marks)

Table 1

Component	System	Function
Service Unit	Pneumatics	To perform forward and reverse motion with equal speed
Shuttle Valve	Pneumatics	To set the constant flow without affected by input and output pressure
Accumulator	Hydraulics	To condition the air so that it is clean, regulated at certain pressure and enrich with oil mist
2-way flow control valve	Hydraulics	Also known as OR gate which provide alternative signal input
Double rod cylinder	Hydraulics	As a power back up for the system when the main power failure

Question 3

(a) Double-acting cylinder travels forward and reverse. Piston diameter 50mm, piston rod diameter 20mm, at compressed air supply pressure of 600kPa.

    i)   Write the formula to calculate the **force** exert on the piston rod with relation of pressure, p and area, A(ignoring friction)

(2 marks)

    ii)   Convert air supply pressure 600kPa to N/m^2

(2 marks)

    iii)   Calculate the effective **area** of piston side and piston rod side.

(2 marks)

    iv)   Calculate the **forward force, F_f and reverse force, F_r** exert on the piston rod during forward and reverse movement.

(4 marks)

(b) A gear pump delivers a volume V = 12 liter/min. It pressurizes a single-acting cylinder with 100 mm diameter piston. Calculate the **forward speed v** of the piston in m/s.

    i)   Write the formula to find **speed**, v, from flow rate, V and area, A.

(2 marks)

    ii)   Convert **flow rate** V = 12 liter/min to m^3/s. ($1m^3$ = 1000 liter)

(2 marks)

    iii)   Calculate piston **area**, A.

(2 marks)

    v)   Use formula at (i) to calculate forward speed, v.

(4 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer TWO (2) questions ONLY.
Please use the answer booklet provided.

Question 3

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;
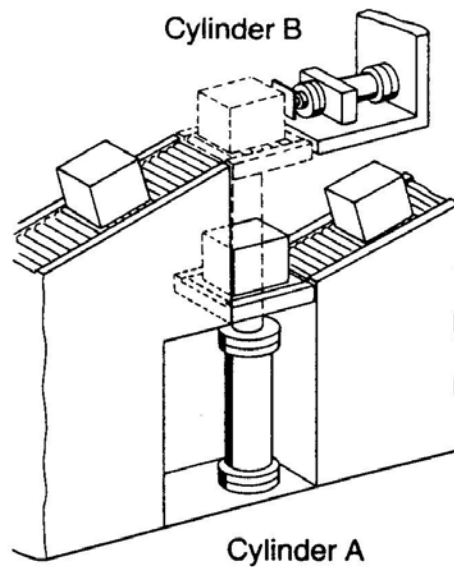

Figure 1

(a)   Draw the displacement step diagram for cylinder A and B.

(4 marks)

(b)   Make the part list of components required for the system.

(6 marks)

(c)   Design the pneumatic circuit.
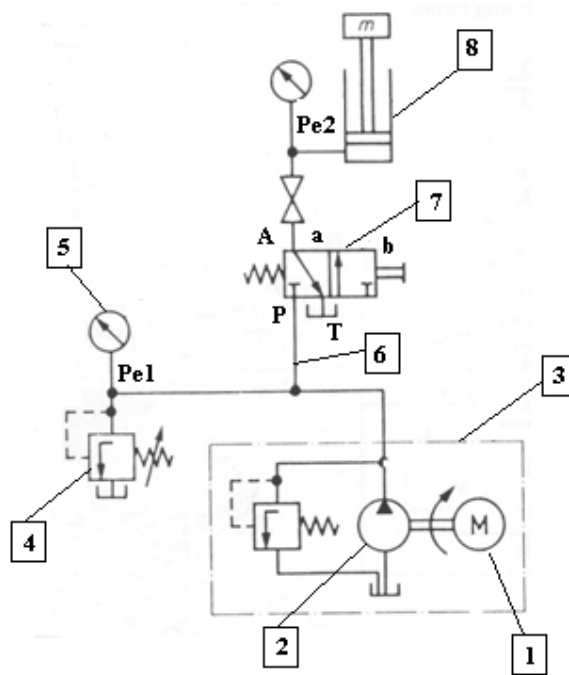
(10 marks)

Question 5

Figure 7

A hydraulic system is used to lift vehicle in an automotive workshop with circuit diagram shown in Figure 7. Answer the following questions based on the circuit diagram above;

a)   Name the components labeled 1, 2, 3 and 4

(8 marks)

b)   Name and state the function of component 7 in the system

(3 marks)

c)   Name and state the function of component 5 in the system

(3 marks)

d)   Explain the function of component 4 in the system

(4 marks)

e)   Explain why is component (5) fitted in front of a component (4)

(2 marks)

Question 6

A scissor lift (Figure3) 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 ispowered by a double acting cylinder.
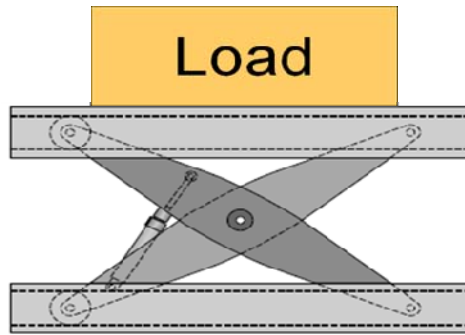

Figure3

(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	1
Hydraulic Power unit	1

(b) Calculate the minimum pressure required, P (N/m^2) to lift a load 20kN with cylinder size 100 mm diameter.

(5 marks)

(c) Calculate the piston speed, v (m/s) if the flow rate is 4.0 l/min and cylinder diameter size is 100 mm.

(5 marks)

END OF QUESTION