UNIVERSITI KUALA LUMPUR
MALAYSIA FRANCE INSTITUTE

FINAL EXAMINATION
JANUARY 2014 SESSION

SUBJECT CODE : FMD 21203
SUBJECT TITLE : PNEUMATICS AND HYDRAULICS
LEVEL : DIPLOMA
DURATION : 2.5 HOURS 3.30 pm - 6.00 pm
DATE / TIME : 05 JUN 2014

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) List THREE (3) functions of service unit in pneumatic system. (3 marks)

(b) State THREE (3) examples of application for single-acting cylinders. (3 marks)

(c) Write THREE (3) advantages of hydraulic systems. (3 marks)

(d) Name THREE (3) types of hydraulic actuators. (3 marks)

(e) Explain the purpose of hydraulic motors. (3 marks)
Question 2

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

I. Double acting cylinder (3 marks)
II. Service unit (3 marks)
III. Pilot control check valve (3 marks)
IV. Adjustable pressure regulator (3 marks)
V. Hydraulic motor (3 marks)

b) Re-match the components of the pneumatic and hydraulic below with its function accordingly. Please refer to Table 1.

Table 1

<table>
<thead>
<tr>
<th>Component</th>
<th>System</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Unit</td>
<td>Pneumatics</td>
<td>To perform forward and reverse motion with equal speed</td>
</tr>
<tr>
<td>Shuttle Valve</td>
<td>Pneumatics</td>
<td>To set the constant flow without affected by input and output pressure</td>
</tr>
<tr>
<td>Accumulator</td>
<td>Hydraulics</td>
<td>To condition the air so that it is clean, regulated at certain pressure and enrich with oil mist</td>
</tr>
<tr>
<td>2-way flow control valve</td>
<td>Hydraulics</td>
<td>Also known as OR gate which provide alternative signal input</td>
</tr>
<tr>
<td>Double rod cylinder</td>
<td>Hydraulics</td>
<td>As a power back up for the system when the main power failure</td>
</tr>
</tbody>
</table>
Question 3

(a) Double-acting cylinder travels forward and reverse. Piston diameter is 0.05m and piston rod diameter is 0.02m, at compressed air supply pressure of $600 \times 10^3$ N/m$^2$. Calculate the forward force, $F_f$, and reverse force, $F_r$, exert on the piston rod during forward and reverse movement.

(10 marks)

(b) A gear pump delivers a volume $V = 2 \times 10^{-4}$ m$^3$/s. It pressurizes a double-acting cylinder with 0.1 m diameter piston. Calculate the forward speed $v$ of the piston in m/s.

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

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

Question 4

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;

(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 complete pneumatic circuit. (10 marks)
A hydraulic system is used to lift vehicle in an automotive workshop with circuit diagram shown in Figure 2. 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 (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.

![Load](image)

Figure 3

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

(10 marks)

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double acting cylinder</td>
<td>1</td>
</tr>
<tr>
<td>4/3-way direction control valve, mid position closed</td>
<td>1</td>
</tr>
<tr>
<td>Pilot controlled check valve</td>
<td>1</td>
</tr>
<tr>
<td>Pressure relief valve with pressure gage</td>
<td>1</td>
</tr>
<tr>
<td>Hydraulic power pack unit</td>
<td>1</td>
</tr>
</tbody>
</table>

(b) Calculate the minimum pressure required, \( P \ (N/m^2) \) to lift a load 2000N with cylinder size 0.1m diameter.

(5 marks)

(c) Calculate the piston speed, \( v \ (m/s) \) if the flow rate is \( 6 \times 10^{-5} \ m^3/s \) and cylinder diameter size is 0.1m.

(5 marks)

END OF QUESTION