FINAL EXAMINATION
SEPTEMBER 2014 SESSION

SUBJECT CODE : FRD20702
SUBJECT TITLE : INTRODUCTION TO COLD ROOM
LEVEL : DIPLOMA
TIME / DURATION : 2.00 PM – 4.00 PM
( 2 HOURS )
DATE : 10 JANUARY 2015

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 question in section A. For section B, answer TWO (2) questions only.
6. Answer all questions in English.

THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.
SECTION A (60 MARKS)

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

Question 1

(a) Specify or write a temperature for common space and product of the following applications:

<table>
<thead>
<tr>
<th>Applications</th>
<th>Common space or product temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Conditioning</td>
<td></td>
</tr>
<tr>
<td>High temperature refrigeration</td>
<td></td>
</tr>
<tr>
<td>Medium temperature refrigeration</td>
<td></td>
</tr>
<tr>
<td>Low temperature refrigeration</td>
<td></td>
</tr>
<tr>
<td>Extra low temperature refrigeration</td>
<td></td>
</tr>
</tbody>
</table>

(10 marks)

(b) List five (5) places where cold room and freezer room are used.

(5 marks)

Question 2

(a) State four (4) main components in a refrigeration system.

(4 marks)

(b) State a function of each component in a refrigeration system.

(4 marks)

(c) Explain in details how the refrigeration system works. State the pressure and temperature changes within the process. Sketches are required.

(7 marks)
Question 3

There are some important features to consider for a cold store. Answer the following:

(a) Explain the following aspects in terms of causes and effects. Show your sketch if necessary.

(i) Air flow problem at evaporator because a fan motor faulty

(ii) Door left slightly open.

(b) Suggest a correction method to the problems.

(i) Air flow problem at evaporator because a fan motor faulty

(ii) Door left slightly open.

(10 marks)

Question 4

There are many parts, materials and components which are used in cold room installation. Describe the function of the following:

(a) Pressure relief port (3 marks)

(b) Digital thermostat (3 marks)

(c) Heater safety control. (4 marks)
SECTION B (40 MARKS)

INSTRUCTION: Answer only TWO questions
Please use the answer booklet provided.

Question 5

100 kg of lean beef is to be cooled from 18 to 4°C, then frozen and cooled to −18°C. The moisture content is 69.5%, so the latent heat is estimated as 233 kJ/kg. Lean beef initial freezing point is −2°C. Specific heat of beef before freezing is 3.52 kJ/(kg·K); after freezing, 2.12 kJ/(kg·K). Estimate the cooling load.

(20 marks)

Question 6

(a) Sketch to show the installation of P-trap for refrigeration piping.

(b) Sketch to show one of the correct installations of multiple evaporators.

(10 marks)

(10 marks)
Question 7

- Internal temperature = -18°C
- Ambient temperature = 30°C
- Internal dimension = 5m W x 6m L x 6m H
- Insulation thickness = 150mm
- Material = foam polyurethane
- External dimension = 5.3m W x 6.3m L x 6.3m H
- Product load = 10,000 kg chicken
- Specific Heat Above Freezing, 4.34 kJ/(kg·K)
- Specific Heat Below Freezing, 3.32 kJ/(kg·K)
- Initial Freezing Point, - 2.8 °C
- Latent heat of fusion of product, 220 kJ/kg

Using the information above and table Q7 below in the design of a cold room, calculate the following:

(a) Heat transmission through the walls (10 marks)

(b) Product refrigeration load (10 marks)

Table Q7: Insulation details

<table>
<thead>
<tr>
<th>Thickness of Insulation</th>
<th>Corkboard</th>
<th>Expanded Polystyrene</th>
<th>Foamed Polyurethane</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 mm</td>
<td>11 KTD</td>
<td>13 KTD</td>
<td>17 KTD</td>
</tr>
<tr>
<td>75 mm</td>
<td>16 KTD</td>
<td>19 KTD</td>
<td>23 KTD</td>
</tr>
<tr>
<td>100 mm</td>
<td>22 KTD</td>
<td>25 KTD</td>
<td>33 KTD</td>
</tr>
<tr>
<td>125 mm</td>
<td>27 KTD</td>
<td>32 KTD</td>
<td>42 KTD</td>
</tr>
<tr>
<td>150 mm</td>
<td>32 KTD</td>
<td>38 KTD up</td>
<td>50 KTD up</td>
</tr>
<tr>
<td>200 mm</td>
<td>43 KTD up</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

For COLD ROOM calculations it is normal commercial practice to ignore the insulating value of air film coefficients and normal building materials, using only the thermal property of the insulating material. Thus, in practice :: Q = A x k/k x T.D.

END OF QUESTION