



**UNIVERSITI KUALA LUMPUR**  
**Malaysia France Institute**

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**FINAL EXAMINATION**  
**JULY 2010 SESSION**

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**SUBJECT CODE** : FRD 20502  
**SUBJECT TITLE** : RAC CONTROL  
**LEVEL** : DIPLOMA  
**TIME / DURATION** : 12.30pm – 2.30pm  
( 2 HOURS )  
**DATE** : 11 NOVEMBER 2010

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

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THERE ARE 6 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

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**SECTION A (60 MARKS)**

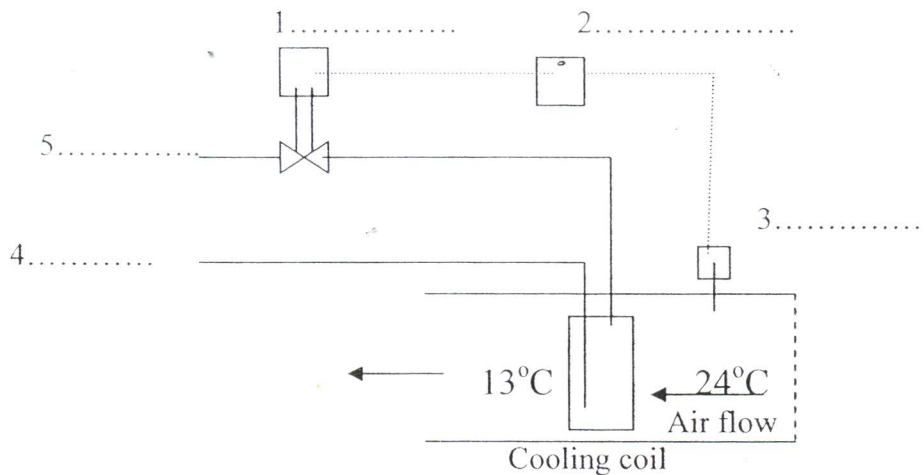
**INSTRUCTION: Answer ALL questions.**

**Please use the answer booklet provided.**

**Question 1**

There are two types of automatic control system. Answer of the following:

- a) Draw a logic diagram of close loop control. (5 marks)
- b) Draw a logic diagram of open loop control. (5 marks)
- c) Refer to Figure Q1, name the three elements of close loop control system as indicated as no. 1, 2, 3 and name the direction of the chilled water flow as indicated as no 4 and 5. (10 marks)

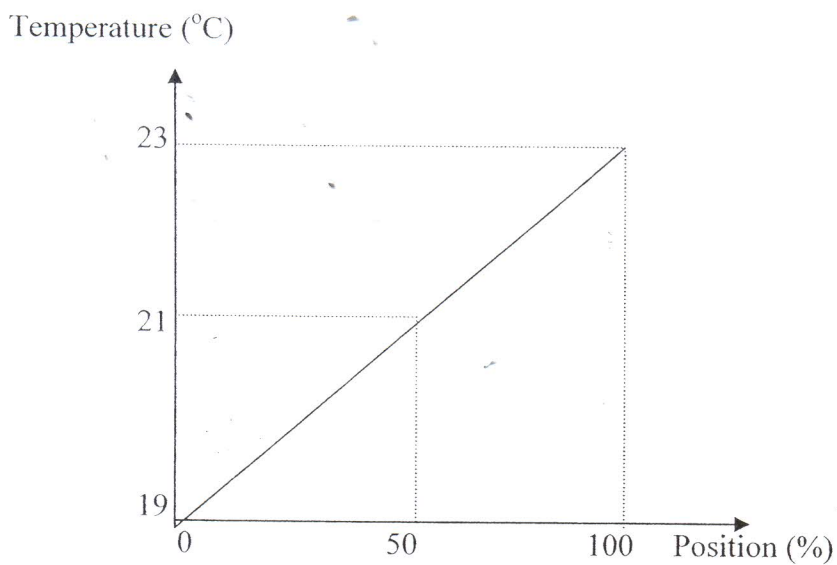


**Figure Q1:** Schematic of a chilled water air conditioning system

**Question 2**

Based on **Figure Q2**, find the following items:

- a) Controlled variable. (2 marks)
- b) Set point. (2 marks)
- c) Differential. (2 marks)
- d) The cut in temperature and cut out temperature of the control valve. (2 marks)
- e) Give two examples of control device that their control modes describe by the curve. (2 marks)



**Figure Q2:** Curve of a control mode.

**Question 3**

There are various control components in an air conditioning and refrigeration system. State the location and purpose of the following control components:

- a) Service valves (2 marks)
- b) CPRs and EPRs (2 marks)
- c) Oil separators and safety controls (2 marks)
- d) Heat exchangers and vibration eliminators (2 marks)
- e) LP and HP controls (2 marks)

Question 4

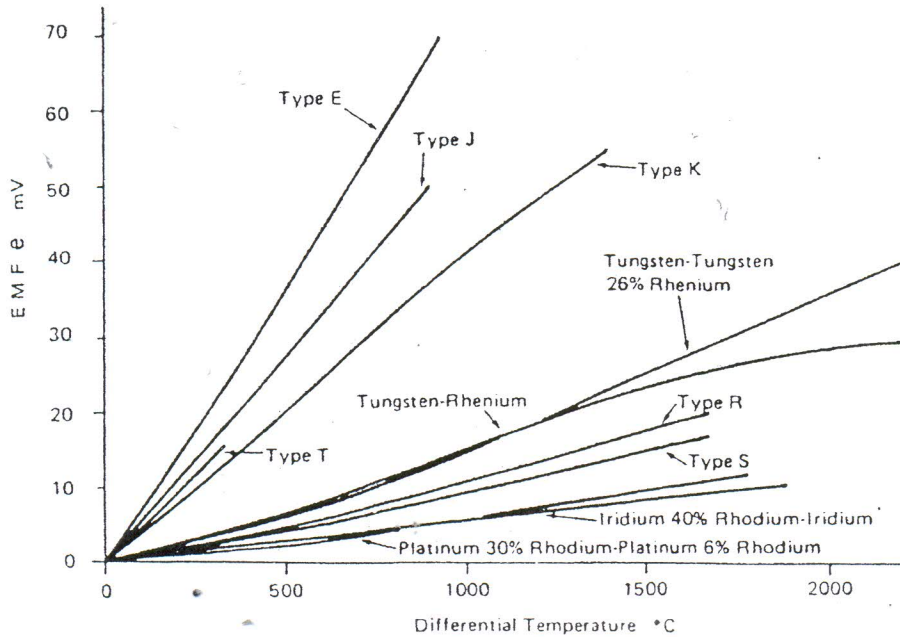


Figure Q4: Curve of input and output of some sensor materials

In electrical transduction thermometers, temperature is converted into an electrical quantity: that is resistance, current or voltage. Answer the following:

- Give three of the most commonly used of this class of thermometer / sensor. (6 marks)
- By referring to the calibration curve of an electrical transduction thermometer material as per **Figure Q4**, select a preferable type of the thermometer and explain why? (8 marks)
- What is it a type of application or equipment in air conditioning and refrigeration suitable to use the selected thermometer / sensor in question 4(b) with the temperature range -184 to 1260 °C. (2 marks)
- Explain the principle of measurement of the sensor in question 4(b). (4marks)

**SECTION B (40 MARKS)**

Answer only **TWO (2)** questions.

Please use the answer booklet provided.

**Question 5**

One of the methods of compressor capacity control is called hot gas bypass. Answer the following questions:

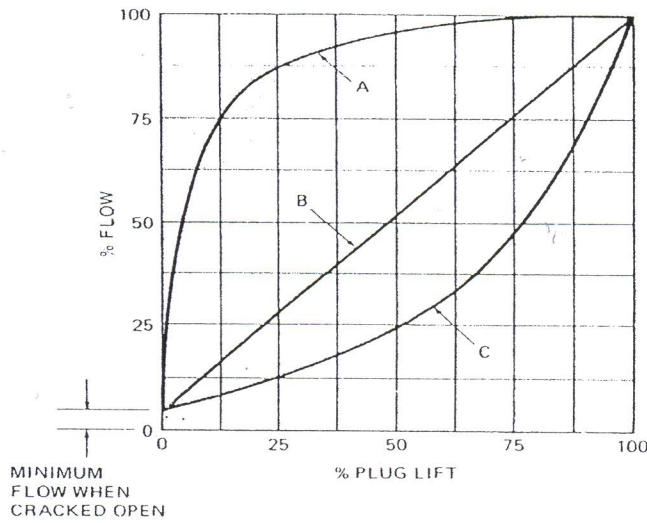
- a) Draw the hot gas bypass in a complete refrigeration system.  
(5 marks)
- b) Explain how hot gas bypass method works in controlling the capacity of the compressor.  
(10 marks)
- c) What is an advantage and disadvantage of the hot gas bypass method?  
(5 marks)

**Question 6**

The valve characteristics curve as per **Figure Q6** shown that the flow in the valve depends on spindle (plug) lift. Explain what is meant by the following characteristics of the valve:

- a) Quick opening characteristic as curve A.  
(5 marks)
- b) Linear characteristic as curve B.  
(5 marks)
- c) Equal percentage characteristic as curve C.  
(5 marks)
- d) Which characteristic curve would you select for controlling chilled water to air conditioning apparatus (example: Air Handling Unit).  
(5 marks)





Valve characteristics. (Courtesy Barber-Colman Company.)

• **Figure Q6:** Valve characteristic curves

**Question 7**

The introduction of computer and data communication technologies has given rise to dramatic developments in management system. In Building Automation System (BAS), one of its applications is Heating, Ventilation and Air conditioning system. Based on the previous statement, answer for the following questions:

- a) List of five of functions of BAS (5 marks)
- b) List of five benefits of BAS (5 marks)
- c) Draw and label the two levels of system of central intelligent Building Management System (BMS). (10 marks)

END OF QUESTION