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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR

MALAYSIA FRANCE INSTITUTE

FINAL EXAMINATION

JULY 2010 SEMESTER

SUBJECT CODE	: FTD32302
SUBJECT TITLE	: WELDING METALLURGY 2
LEVEL	: DIPLOMA
DURATION	: 9.00am – 11.30am (2.5 HOURS)
DATE / TIME	: 12 NOVEMBER 2010

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 4 PRINTED PAGES OF QUESTIONS, AND 1 PAGE OF SCHAEFFLER DIAGRAM EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

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

Question 1

Give **TWO (2)** objectives of adding alloy elements to carbon steels.

(4 Marks)

Question 2

Explain why small amount of ferrite (5-10%) in final phases of welding austenitic stainless steels is able to prevent hot cracking.

(8 Marks)

Question 3

Briefly discuss the characteristic of impurities may promote to hot cracking in weldment.

(8 marks)

Question 4

List **TWO (2)** name of intergranular corrosion occur in weldment and explain the differences.

(8 Marks)

Question 5

State **THREE (3)** general factors that affecting the weldability of Aluminum and its alloys.

(6 Marks)

Question 6

Sketch the region of weld decay for double V butt joint.

(6 Marks)

Question 7

Discuss the advantages of duplex stainless steel compare to other group of stainless steel.

(10 Marks)

Question 8

Explain in detail the purposes of adding 2% Molybdenum and more than 12% Nickel in 316L stainless steel.

(10 Marks)

SECTION B (Total: 40 marks)

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

Question 1

Selection of correct filler metal is one of a critical factor to encounter cracking in dissimilar joint. Assume 20% dilution has involved for welding SS321 and SA283 plates using SMAW process.

(a) Use a graphical method to predict the final percentage of ferrite if use E308 and E309MoL electrodes.

(12 Marks)

(b) Choose the best filler metal and give your reason.

(4 Marks)

(c) Explain the effect of dilution to your selection.

(4 Marks)

Note: Base and filler metal chemical compositions are given in Table 1.

Table 1: Chemical compositions

	Base metal (%)		Filler Metal (%)	
	SS321	**SA 283**	**E308**	**E309MoL**
Carbon	0.08	0.24	0.08	0.02
Manganese	2.0	0.9	1.5	0.75
Chromium	19.0	-	22.0	22.5
Silicon	1.0	0.4	0.60	0.9
Nickel	12.0	-	11.0	12.0
Molybdenum	2.0	0.7	0.2	2.5
Titanium	0.7	-	-	-
Nitrogen	0.1	-	0.05	0.06
Cooper	-	0.2	0.75	-
Sulphur	0.030	0.03	0.030	0.03
Phosphorus	0.045	0.045	0.030	0.03
Iron	Balance	Balance	Balance	Balance

Question 2

Knife line attack occurs in stabilize austenitic stainless steels due to formation of chromium carbide precipitate ($Cr_{23}C_6$) adjacent fusion zone.

(a) Why area of knife line attack is very narrow?

(6 marks)

(b) Explain detail, why chromium carbide precipitate ($Cr_{23}C_6$) still occur although stabilize austenitic stainless steels contain titanium.

(10 Marks)

(c) Give **TWO (2)** prevention methods of knife line attack.

(4 Marks)

Question 3

General properties of aluminum alloys are light weight, good corrosion resistance and high strength to weight ratio. These make aluminum alloy suitable for aero, auto and marine applications. However, several problems associated with welding of aluminum alloys such as porosity, solidification cracking and lost of strength that reduce their weldability.

(a) Discuss the important of cleaning of base metal before aluminum welding is done.

(6 Marks)

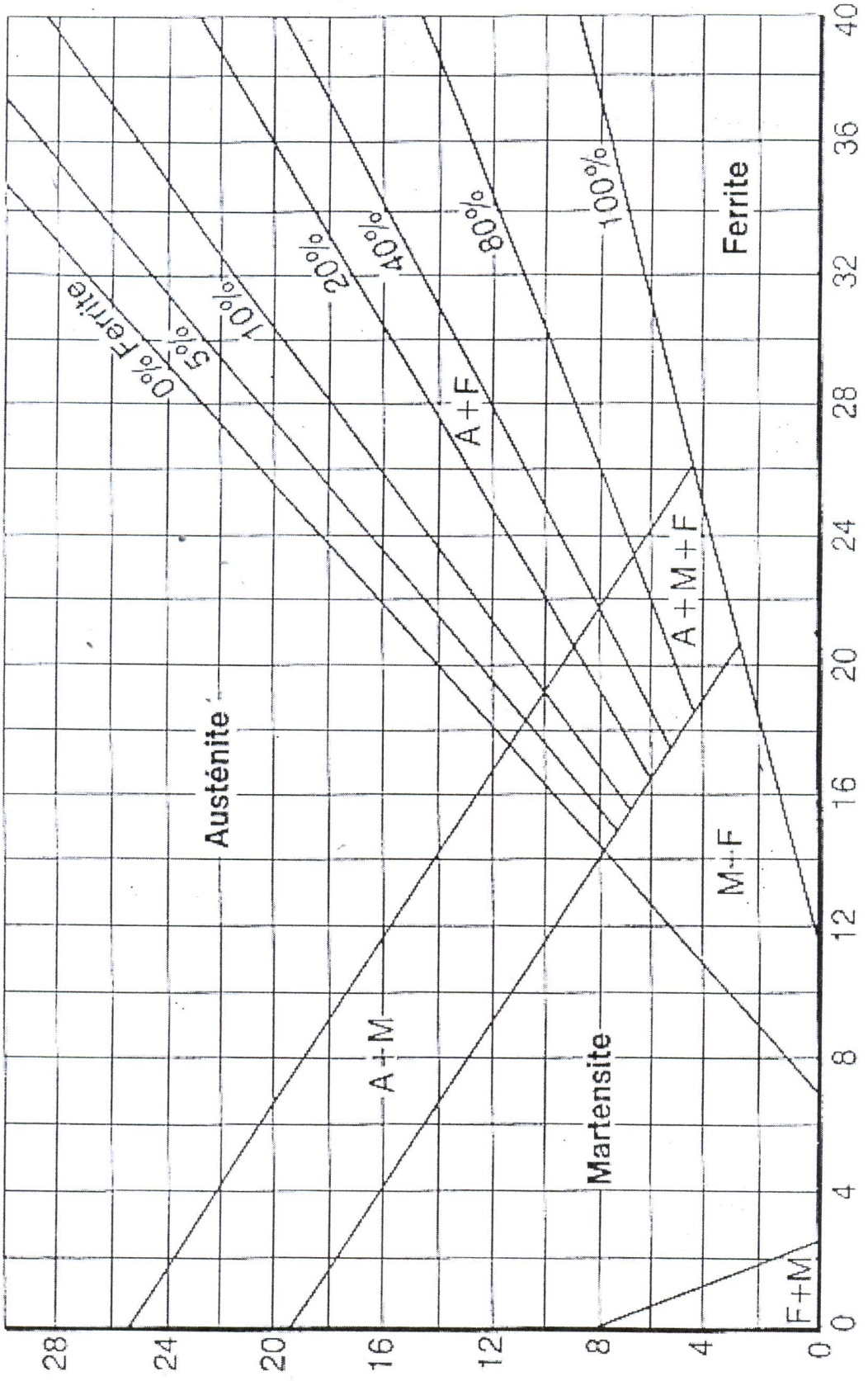
(b) Porosity is a common defect in welding of aluminum and the biggest diameter size of porosity can be up to 4mm. Explain the causes of porosity and how to prevent.

(10 Marks)

(c) Explain how lost of strength occur in non heat treatable aluminum alloys.

(4 Marks)

Appendix 1



Nickel Eq = %Ni + (30 X %C) + (0.5 X % Mn)

Chromium Eq = %Cr + %Mo + (1.5 X %Si)+ (0.5 X %Nb)