



UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2011 SEMESTER

SUBJECT CODE : FTD 32302
SUBJECT TITLE : WELDING METALLURGY 2
LEVEL : DIPLOMA
TIME / DURATION : 3.30pm – 6.00pm
(2.5 HOURS)
DATE : 05 MAY 2011

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) questions only.
6. Answer all questions in English.

THERE ARE 4 PAGES OF QUESTIONS AND 4 PAGES OF APPENDIX, EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)**INSTRUCTION: Answer ALL questions.****Please use the answer booklet provided.****Question 1**

Welding properties can be determined by using Schaeffler diagram. Answer the following questions. (Please refer to Appendix 1, 3 and 4 for the questions below and attach the schaeffler diagram to the answer books let)

(a) A dissimilar material A516 and 347 austenitic stainless steel plates will be joined using E308L electrode. Assume 20% dilution was involved. Use the graphical method to solve this problem.

1. Calculate the chromium and Nickel equivalents

(5 Marks)

2. Plot both equivalents on the schaeffler diagram.

(5 Marks)

(b) Estimate the ferrite content of final structure in weld metal area for welding lifting lugs (SA 1020) and head (SS 316) in the project pressure vessel. Assume 30% dilution was involved if filler metal E316L was used. Use calculation method to solve this problem.

1. Calculate the dilution of the weld metal

(3 marks)

2. Calculate the chromium and nickel equivalents of the weld metal in question 1.

(2 Marks)

3. Plot both equivalents on the schaeffler diagram.

(5 Marks)

Question 2

Answer the following questions.

a) Explain the problems in joining dissimilar metal.

(8 Marks)

b) Give **TWO (2)** methods in determining the final phases.

(2 marks)

- (c) Consider the welding of A1010 steel to a 304 stainless steel. Assume dilution involved 30%. Estimate the final ferrite composition of the fusion weld electrode if E309L was used.(graphical method)
(Please refer to appendix 1 and 2)

1. Calculate the chromium and Nickel equivalent of the materials used.
(5 Marks)
2. Plot the final equation of chromium and Nickel on the provided schaeffler Diagram.
(5 Marks)

Question 3

Alloy Steel has special properties than steel. Answer the following questions.

- a) Give four(4) basic elements of Alloy Steels
(4 Marks)
- b) What is the different between Carbon steel and alloy steel?
(4 Marks)
- c) What are the purposes of adding manganese to steel?
(4 Marks)
- d) What is the purpose to designed High Strength Low Alloy (HSLA) Steels?
(8 Marks)

SECTION B (Total: 40 marks)

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

Question 1

Answer the following questions.

- (a) Explain the meaning of Aluminium alloy designation number below:
• AA5052 (4 marks)
- (b) Determine the common weld defect in Aluminium. (4 marks)
- (c) What are the advantages of Aluminium alloy (4 Marks)
- (d) Describe Aluminium oxide. (8 Marks)

Question 2

Answer the following questions:

- a) Classify the types of welds cracking in weldment
Main classification (4 marks)
- b) Give **TWO (2)** factors that influence solidification cracking. (2 marks)
- c) Determine the different between Solidification Cracking and Hydrogen cracking? (3 Marks)
- d) Define lamellar tearing and hot cracking (4 marks)
- e) Determine the sources of hydrogen cracking. (6 marks)

Question 3

Answer the following questions.

a) Determine the source of knife line attack in Stainless Steels

(6Marks)

b) Define knife line attack?

(4 Marks)

c) Explain how to prevent the knife line attack?

(10 Marks)

END OF QUESTION

Appendix 1

Table 1: Chemical Composition of Stainless steel

Type	Carbon	Chromium	Nickel	Others †
302	0.15	17.0	8.0	-
303	0.15	17.0	8.0	0.20 P, 0.15 S (min), 0.60 Mo
304	0.08	18.0	8.0	-
304L	0.03	18.0	8.0	-
305	0.12	17.0	10.0	-
308	0.08	19.0	10.0	-
308L	0.03	19.0	10.0	-
309	0.20	22.0	12.0	-
309L	0.03	22.0	12.0	-
309S	0.08	22.0	12.0	-
310	0.25	24.0	19.0	1.5 Si
314	0.25	23.0	19.0	1.5 - 3.0 Si
316L	0.03	18.0	14.0	Mo - 2.0

† Unless otherwise noted, other elements of all alloys listed include maximum contents of 2.0% Mn, 1.0% Si, 0.045% P and 0.030 % S. Balance is Fe.

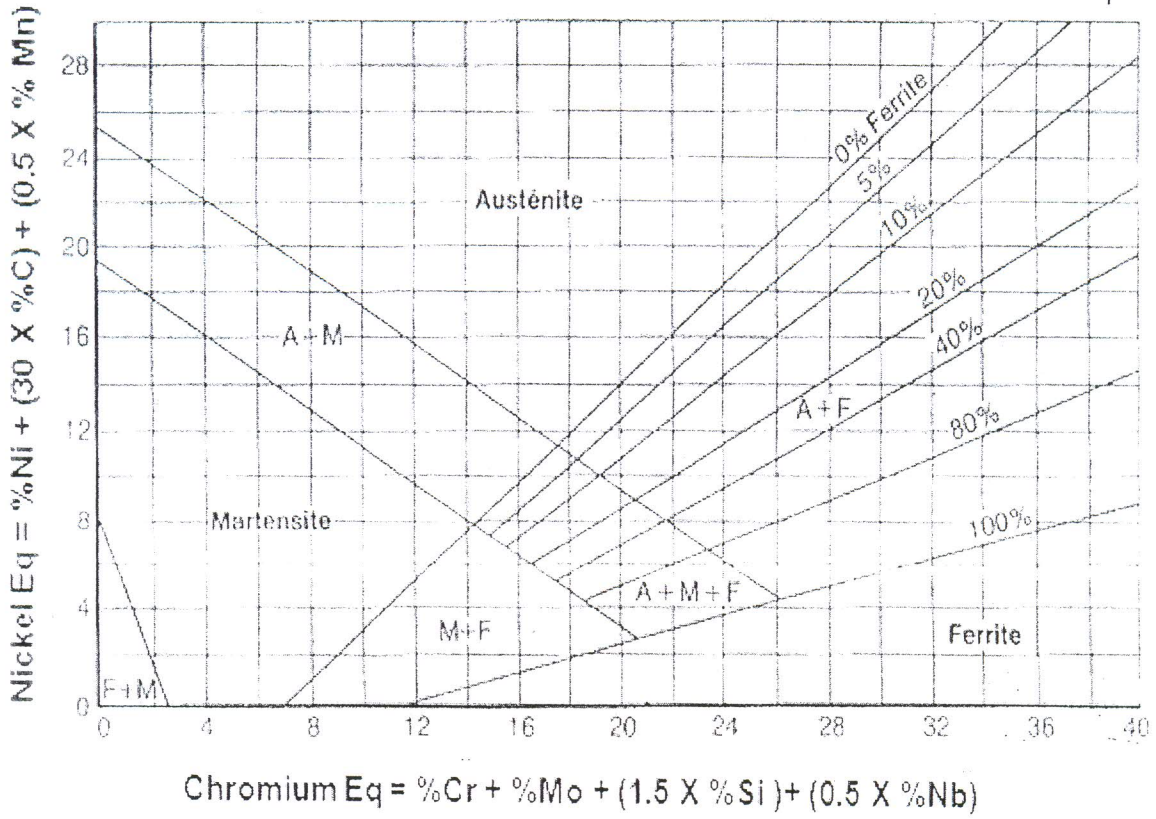
Table 2: Material Composition for carbon steel

Composition (%)					
Type	Carbon	Manganese	Silicon	Phosphorus	Sulfur
SA1008	0.08	0.50	0.30	0.04	0.045
SA1010	0.10	0.60	0.30	0.04	0.045
SA1015	0.15	0.60	0.30	0.04	0.045
SA1018	0.18	0.90	0.30	0.04	0.045
SA1020	0.20	0.90	0.40	0.04	0.045
SA1022	0.22	1.00	0.40	0.04	0.045
SA1025	0.25	0.60	0.40	0.04	0.045
SA1030	0.30	0.90	0.40	0.04	0.045

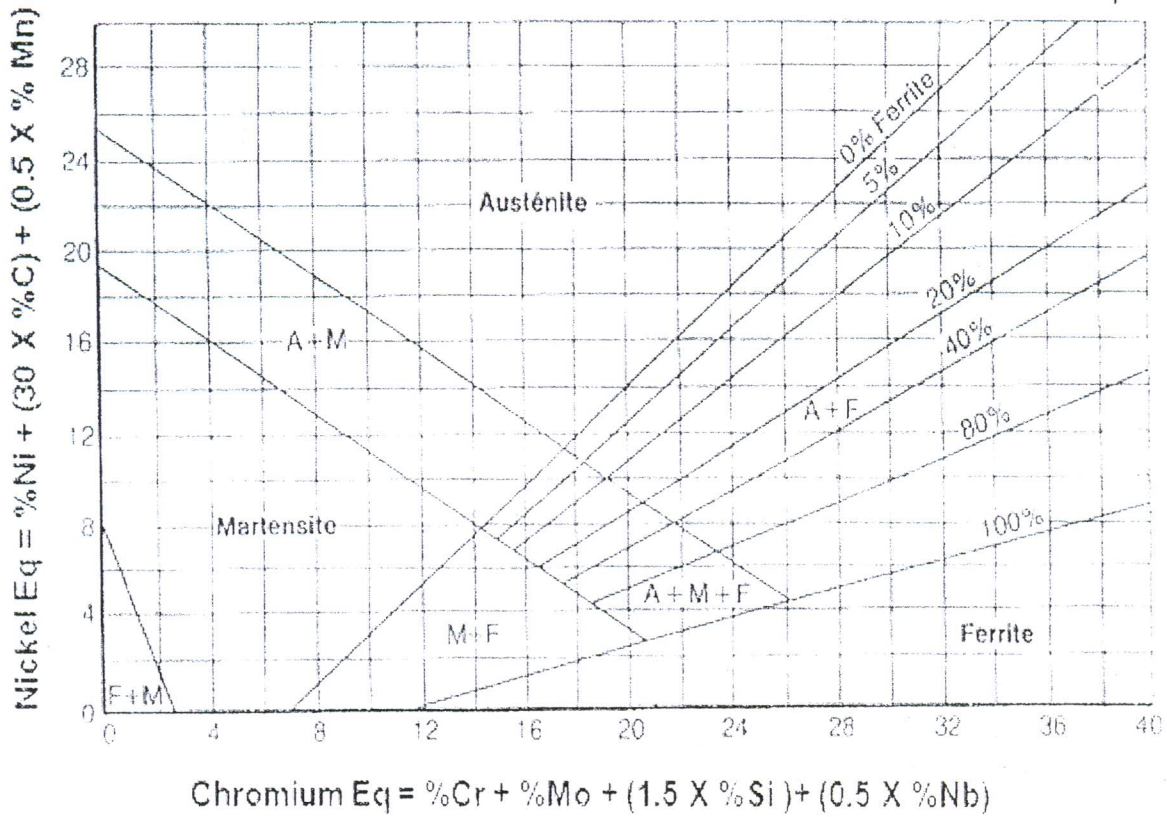
Note - Balance is Fe

Appendix 2

Schaeffler Diagram



Schaeffler Diagram



Schaeffler Diagram

