



UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2010 SESSION

SUBJECT CODE	:	FWB 32802
SUBJECT TITLE	:	WELDING MECHANICS
LEVEL	:	BACHELOR
TIME / DURATION	:	4.00pm – 6.30pm (2.5 HOURS)
DATE	:	04 MAY 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 three (3) questions only.
 6. Answer all questions in English.
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THERE ARE 6 PAGES OF QUESTIONS, AND 1 PAGE OF FORMULAE EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)**INSTRUCTION: Answer ALL questions.****Please use the answer booklet provided.****Question 1**Heat transfer consists of **THREE (3)** modes. Draw and explain the three modes.

(6 Marks)

Question 2Describe what residual stress is and state **TWO (2)** importance of residual stress.

(8 Marks)

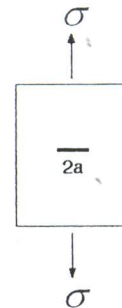
Question 3

Describe a ductile fracture.

(6 Marks)

Question 4A simple case for stress intensity factor, K_I are such that

$$K_I = \sigma \sqrt{\pi a}, \text{ pulling apart forces, } \sigma \text{ is 400 MPa and } 2a \text{ is 50mm}$$

(a) determine K_I (MPa m^{1/2})(b) determine K_I if $2a = 70\text{mm}$ 

(10 Marks)

Question 5

Fatigue is the mechanism whereby cracks grow in a structure. In welded steel structures, fatigue cracks will almost certainly start to grow from welds, rather than other details. Growth only occurs under fluctuating stress. With this statement, give a concise reason for weld fatigue.

(10 Marks)

SECTION B (Total: 60 marks)**INSTRUCTION: Answer THREE (3) questions only.****Please use the answer booklet provided.****Question 1**

- (a) With the given schematic cross section of a weld below, describe the expansion and contraction of the localized heating and how it influences its surrounding. The necessary arrow indications should be made in the drawings.

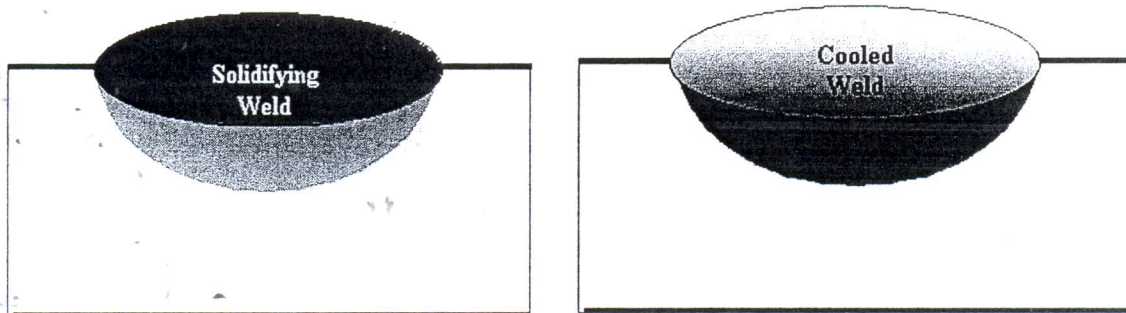


Figure 1 Cross Section of a Welded Plate.

(8 Marks)

- (b) Hardness is the ability of a metal to resist penetration and wear by another metal or material. In terms of production of quality gears, it has led to many improvements. Describe the improvement that has been made.

(6 Marks)

- (c) Name the **TWO (2)** techniques to induce hardness to gear tooth.

(6 Marks)

Question 2

Suppose that welding is done as an example in Figure 2. That condition was 300 amps and 26 volts. The given travel speed is 10 in/min. This works out to a heat input of 44,600 joules/in.

- (a) What would the heat input be in the second condition; if current are 250 amps and 27 volts, and the travel speed is still at 10 in/min.

(12 Marks)

- (b) How many percent of the current is reduced?

$$\text{Heat Input} = \frac{\text{Amps} \times \text{Volts} \times 60}{\text{Travel Speed (in/min)}}$$

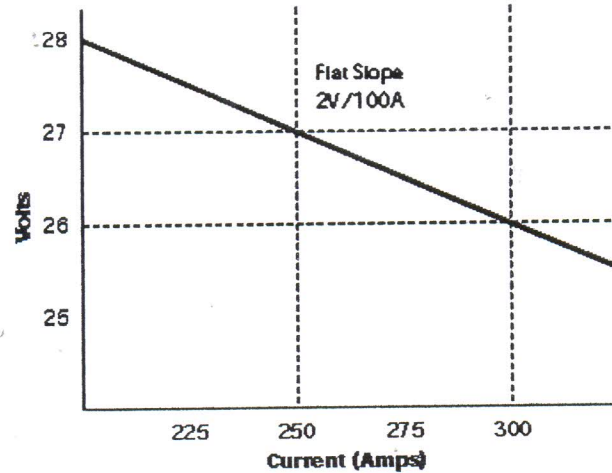


Figure 2 Voltage Drop Diagram against Amperage.

(8 Marks)

Question 3

According to AWS, a flaw is an undesired discontinuity. Many large structures may contain flaws. In this context state:

- (a) Fitness for purpose or fitness for service of a pressure vessel.

(5 Marks)

- (b) The Comet aircraft had a fuselage of clad aluminum, with $G_c \approx 300$ in-psi. The modulus Young, E is 11×10^6 Nm. While the hoop stress, σ due to relative cabin pressurization was 20,000 psi. Find that stress, α the length of crack that will propagate catastrophe. (use the given formula

$$a = \frac{G_c E}{\pi \sigma^2} \text{ [in]} \quad)$$

(15 Marks)

Question 4

It is good to remember the practices that are useful to control distortion often simultaneously reduce welding costs.

- (a) Describe what is meant by shrinkage. Give an example.

(5 Marks)

- (b) With the diagram provided, label each shrinkage control methodology below and describe the methodology of diagram 1 and diagram 2.

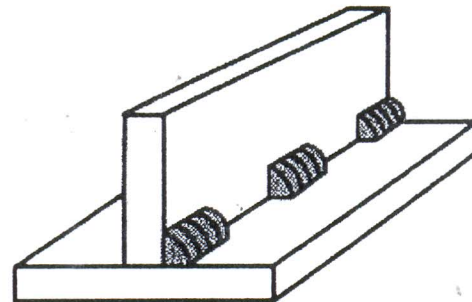
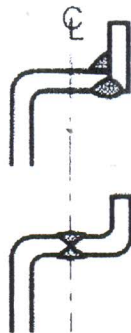
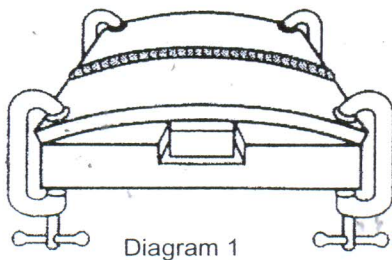


Figure 3 Practical Ways to Minimize Distortion.

(15 Marks)

END OF QUESTION